IN THIS ISSUE: A Year of Electrical Progress in the West

JOURNAL OF ELECTRICITY

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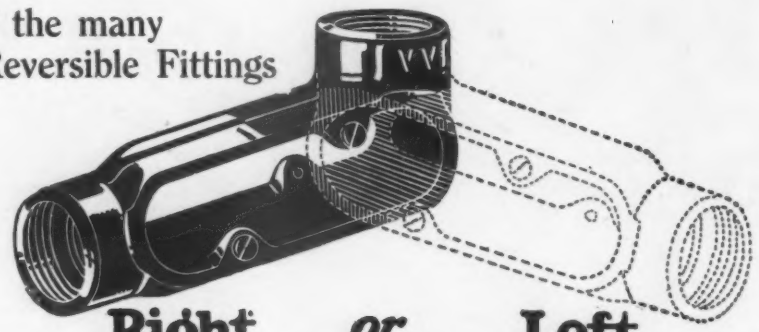

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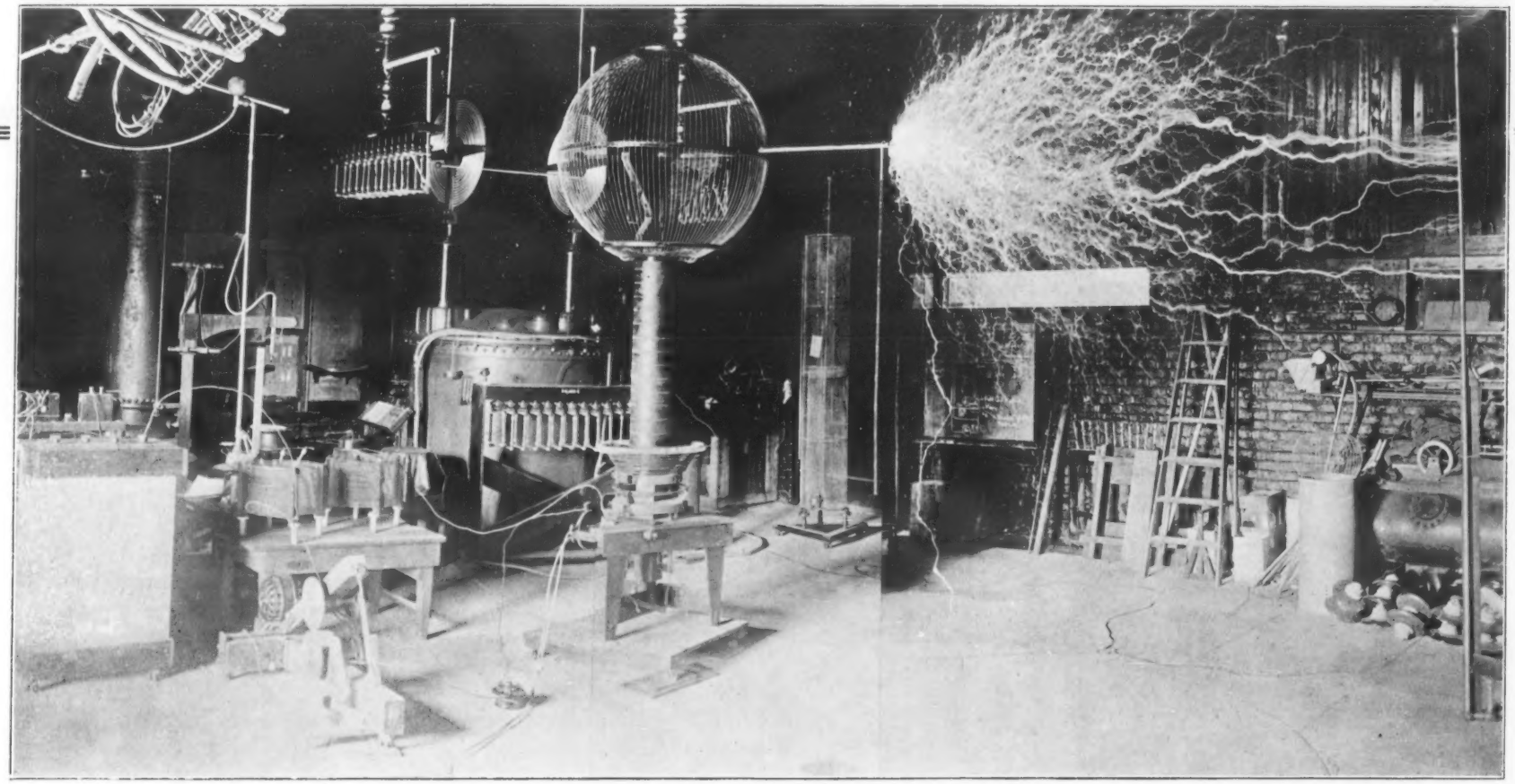

Jumping a 111-inch Spark Gap With 1,660,000 Volts

ONE of the most significant advances made in the past year in the West has been in the field of high tension transmission, in which the West has always led the way. It is not sufficient that the plans for 220,000 volts be worked out theoretically, but the results must be checked up with actual equipment duplicating field conditions as nearly as possible. This illustration shows the interior of the high voltage laboratory of the Leland Stanford Junior University where Professor Harris J. Ryan of the department of electrical engineering has worked out an oscillator which is here shown operating at 1,660,000 volts discharging over a 111-inch gap to ground.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

Volume 45 SAN FRANCISCO, DECEMBER 15, 1920 Number 12

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LOOKING BACK—AND AHEAD

THE last day of the business year should be set aside for the purpose of retrospection and for the weighing up of assets and liabilities. Not only the balance sheet should be consulted but also the friends made and lost, the contracts made and lost, and the general reputation and standing of the business. What has the year 1920, now drawing to a close, meant to the electrical industry? Has it advanced as far as was possible in the past twelve months or has it been retarded in its growth by unsettled conditions, bickering between branches in the industry or by a feeling of discontent among the employes of the companies representing the industry and a lack of confidence by the public?

In spite of unsettled financial conditions, power company securities have been absorbed by the market in record-breaking time, showing the confidence of the people in this basic industry. Construction of large plants is now under way all over the West and in California alone there are seventeen projects totaling 390,000 horsepower in the process of construction. The spread of the cooperative idea into the Northwest and the Intermountain district has brought about a unified industry, playing the game "all for one and one for all," with the sole idea of giving better service to the public. The spread of customer ownership of stock and the sales of securities to employes on advantageous terms have made a group of stockholders who are boosters for the industry and who are vitally interested in the welfare of the industry.

Improved methods of merchandising, the spread of the electrical home idea, and closer cooperation between the supply jobbers and manufacturers have marked the increased commercial efficiency of the industry in the past year, while the engineers have set new records in design and installation in almost every possible phase of power generation and distribution.

The convention of the National Electric Light Association held in Pasadena this year gave the West an opportunity to prove the statements it had made for many years regarding those records established in hydroelectric generation, transmission and distribution. A practical understanding of cooperation was taken back by those from the East who had a chance to see the results obtained by the California Electrical Cooperative Campaign, and cooperation within the industry was doubtless given a good start as campaigns have been inaugurated in various parts of the country since the convention.

What does 1921 hold in store for the manufacturer? With the plants that are planned and their transmission and distribution systems, the new blocks of power made available for industrial purposes, the increased building activity due to a lowering of building costs and the shortage of homes, it looks like a busy and prosperous year. The jobber and contractor-dealer are going to be busy keeping up with demand for convenience outlets in the modern electrical homes that will be built, and an appliance for every outlet. The power companies have a good wet year ahead which will mean fewer kilowatt-hours produced from steam and the ability to take up contracts and extensions which they have hitherto had to refuse, due to lack of capacity.

With the price of coal and fuel oil going steadily up, and nearly seventy per cent of the undeveloped water power of the United States west of the Rockies, the future holds great possibilities for the development of industries in the West. This however can only be brought about if the power companies are allowed to expand and develop those natural resources, and upon the growth of the central stations depends the growth of the other branches of the electrical industry, of all industries and of the West. Therefore during the coming year every member of the electrical industry should work toward this end—to bring about an electrified West.

DO YOU REMEMBER

—when aluminum conductors were used for the first time by the Snoqualmie Falls Power Company in what was then long distance transmission from the Snoqualmie Falls plant into Seattle?

"The simplest and easiest way for a utility to secure public good will is to offer sound securities to the people it serves. The simplest and easiest way for a citizen to obtain adequate utility service at just rates is to invest money in the utility company. On the one hand the company secures peace and appreciation; on the other, the citizen secures a faithful and responsive public servant."

Customer Ownership of Securities

To these two axioms, stated by William H. Hodge in his article on Customer Ownership of Securities which appeared in the November 20 issue of Electrical World, might be added another one. The simplest and easiest way to secure the confidence of the public in the power companies is for other branches of the electrical industry to invest in power company securities. That confidence begets confidence is a well known fact, and when it becomes known that all the members of the electrical industry are purchasing power company securities, the moral effect upon the public will be such that the confidence of the public in their local power companies will be greatly strengthened.

The work of the San Francisco Electrical Development League in organizing a committee to work with a similar committee from the Pacific Division of the Electric Supply Jobbers' Association for the purpose of selling central station securities to members of the industry should be heartily supported. Other electrical organizations throughout the West should make similar drives to carry on this good work of effecting a widespread sale of securities within the industry as a means of proving to the public that the industry has faith in itself and is willing to back up that faith.

Analysis of Public Utility Complaints

Several interesting aspects of the attitude of the public toward their public utilities are brought out by an analysis of the recent report of the California Railroad Commission covering the informal complaints which had been lodged with that body during the year 1919-1920. Of the total of 2663 such complaints, only 487 were questions relating to rates, the others alleging poor service of one sort or another. Telephone and telegraph companies seem to have been the most unpopular, while of the complaints specifically to be charged against electric service corporations, 104 referred to rates, 170 complained of the service and 194 were due to difficulties in regard to installations, extensions and cancellations. An interesting sidelight on the jitney situation is given by figures which show that only 82 complaints were registered against electric railroads, while auto trucks and stages, although these carried much fewer passengers, were the cause of 196 complaints. Practically all the difficulties were adjusted to the satisfaction of both parties.

The comparatively few objections to rates in a year which was marked by frequent upward revisions of the rate schedule is alike a tribute to the reputation for fairness which the Railroad Commission bears and at the same time is significant of a general attitude on the part of consumers, who are willing to pay whatever a service is worth, but are inclined to insist on the quality of that service. What a very small proportion of the electric companies' customers are dissatisfied is to be seen when total figures are compared. Taking the 18 largest utilities in the state, the number of complaints per each 1000 gas and electric consumers ranged from .25 to 6.07, or considerably less than one per cent.

Public Scepticism Toward Cooperation

The electrical man who is familiar with the progressive and disinterested work of the various cooperative movements in the electrical industry is occasionally shocked by public scepticism of all alliances labeled cooperative. A general flavor of secret sessions and of price juggling has been associated with certain cooperative marketing schemes of his past experience which have started with a flourish of publicity announcing their unselfish purposes and have ended in a lawsuit. Unless he is convinced to the contrary, the ardent reader of his morning paper is inclined to suspect all virtuous movements which may thereafter come under his notice.

It therefore behooves the various electrical cooperative campaigns now under way in the West to see to it that this average citizen does fully understand the purpose and methods of the outlined work. The California Electrical Cooperative Campaign has made such an advertising of its purposes a part of its regular work. The secretary of the Campaign, officers of its Advisory Committee, members of the technical press and others have taken every opportunity to tell of this movement before representative organizations, with the result that more than one body has interrupted with enthusiastic applause. The public as a whole is impressed with the fact that this organization is working in its interest and that its aims mark a new level of business ethics to which other fields of business enterprise might well strive to attain. This warning is sounded as a bit of advice to the new movements now starting who have it within their power either to capitalize their work with returns of public good will or to suffer an inevitable element of suspicion consequent upon misunderstanding. It pays to advertise.

The Power Company and the Public

With the extensive construction programs of Western power companies should go a program of educating the public to just what this work really means to the West. Special attention must be given to Mr. Common Citizen who packs a few blankets and a frying pan into his Ford and hies him toward the hills for a vacation. There he finds his favorite camping spot littered up with old concrete forms, finds a rusty pipe sucking the water out of his favorite spring, and comes back to his little circle of acquaintances with a big grief that the electric light company is spoiling the hills for-

ever. That story goes on and on, getting a little worse for the power company each time.

To counteract such a feeling it will be necessary for the power companies to do some real educational work. As soon as a construction job is finished and everything cleaned up and made spick and span again, make friends with the automobile editor of the local newspaper and take him on a trip over that job. Show him the lake that has been made larger and thus a greater asset to that part of the mountains; tell him of the trout fry planted there. Show him the new roads built and maintained, making that section more accessible and safer for automobile travel. Set up conveniences for auto parties near the reservoirs and other scenic spots on the project, and invite campers and travelers to make use of the properties of the company. By this kind of work the average citizen, the consumer and the nature lover may be made to realize that the construction works of the power companies are really making the mountains more accessible and instead of destroying their beauty are adding to it.

Factors Involved in Rapid Growth

The progress curve of most Western utilities rises at an acute angle, the present capacities of such systems often having doubled within a ten year period. Looking forward into the future, even more ambitious plans are contemplated. One California company, indeed, if it carries out the schedule which it has filed with the Railroad Commission, will be four times its present size by 1930. This rapid growth must be taken into consideration in deciding many of the engineering problems which arise. It is a fact, for instance, that many systems outgrow their equipment before they wear it out, and in consequence it does not always pay to carry out preservative measures which otherwise would prove economies. This fact was brought out in a recent discussion of pole treatment, by an engineer who stated that his company had found that poles were often replaced in order to make way for equipment to carry higher voltage or for other revision of the system long before they had completed their period of usefulness. The discarded poles have very little value as scrap, being marred both in use and by the process of removal, and are usually reckoned off the books. This situation is not an unusual one, although of course, it is always dependent upon special conditions. The very possibility of these special conditions arising, however, is a factor which must be reckoned with as an element peculiar to the West.

"Fixed Charges" in Water Power Rates

In spite of the popular favor in which water power is held, the company which derives its power from that source labors under one special difficulty in its relations to the public which is not shared by the concern utilizing steam plants. This is due to the misconception of the element of "fixed charges," or the return on investment and other elements which go to make up overhead and which are properly reckoned in as part of the cost of production. The steam utility's costs of manufacture respond quickly to market conditions; both fuel and labor go up in price with a general increase, and it is a simple matter to convince the public that higher rates are a necessity. The labor element is a much smaller item in the hydroelectric system, on the other hand, and with no change apparent in the cost of operating the machinery, it becomes a more difficult affair to satisfy the consumer that a rate increase is necessary.

There is undoubtedly need for an educative campaign to disabuse the public of the impression that the cost of electricity generated by water power must be very low because the water costs little or nothing. Companies who now have construction work going on are in a position of peculiar advantage to carry

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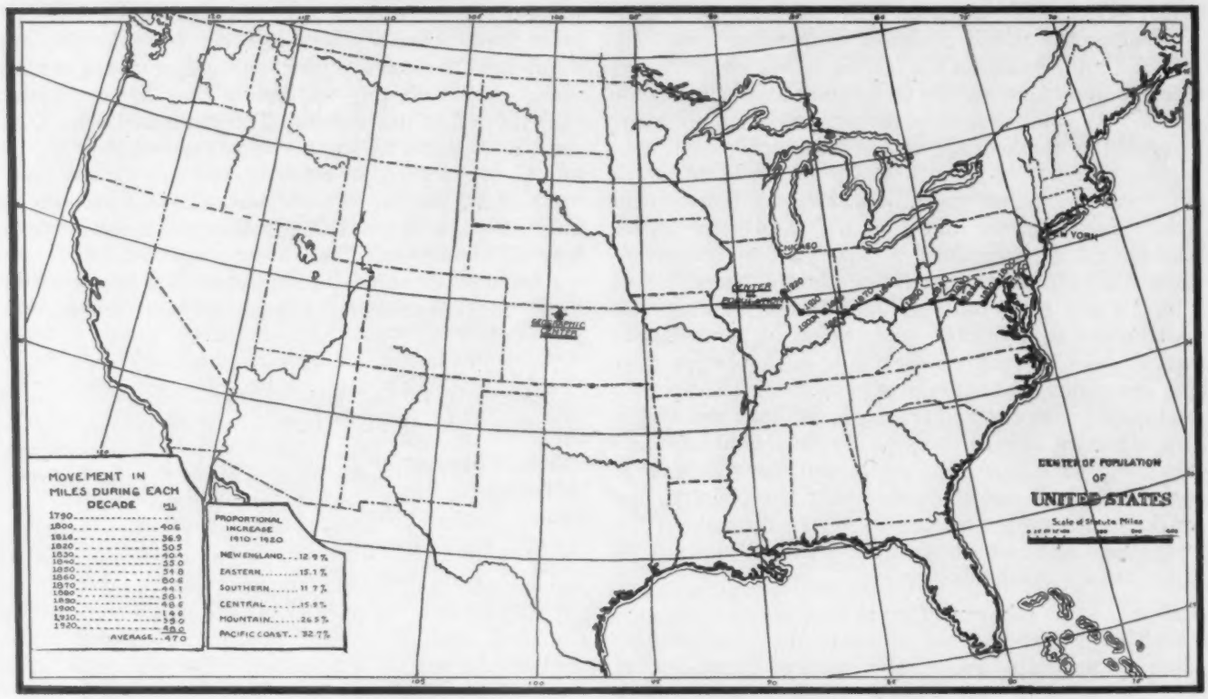
SUCCESSFUL HANDLING OF THE TEREDO-LIMNORIA PROBLEM

The inroads of the teredo limnoria wherever piles or other wood structures are reached by salt water have become a serious problem to many western power companies where power lines or electric railways come in contact with coast or bay waters. The Puget Sound Power and Light Company, who have had much trouble with these pests in connection with a trestle of some length used by their interurban lines near Bellingham, Wash., have recently had great success in reinforcing the damaged piles and preventing further inroads through the use of the cement gun. The appearance of the piles before and after treatment is here clearly shown, as well as the simple method of applying the cement.



WESTWARD THE COURSE OF EMPIRE

Since the first census was taken in 1790, each ten-year period has shown the center of population for the United States moving steadily westward, as here indicated by the successive dates. The official center for 1920 has not yet been announced, but an informal calculation shows that this point now lies almost directly south of Chicago. The states west of the Rocky Mountains show an average increase of 39.1% over their population figures for 1910, while the nation as a whole in 1920 was only 14.9% larger than it was at that period. In other words, the West is not only the great producer of raw materials, but is becoming more and more a power in the nation's markets, a fact which has played an important part in the steady industrial development which has kept pace with population increase.

out such educative work. The sight of the tremendous engineering activity necessary to build a dam or construct a power house is a very impressive lesson in the initial expenditure upon which an interest return must later be earned. The completed structure grips the imagination in no such way—but in the absence of active construction work, it would be of value to encourage the familiarity of the public with the extent of the company's properties and structures, which will not only help in the sale of bonds but will lay a foundation of respect for the extent of the investment involved and will spread a more general realization of the costs back of rate charges. This element is an intangible one, but should not be overlooked in planning advertising and otherwise discussing matters relative to public relations.

Are We Downhearted?

During the war soldiers returning to the front from the hospitals would show their spirit when one of them would call out, "Are we downhearted?" and from each and every one would come a roar of "No!" and a long cheer. Shoving up toward the fields of horror from the peace and quiet of a hospital ward, knowing only too well the suffering and privations in store for them, these men still had the unshaken faith in themselves and their cause which enabled them to keep up a cheerful spirit.

The business world in general is going back to battle after three years of order filling; is going back to face keen competition and a general cutting of prices to maintain business. The central stations have had a hard time these past three years petitioning regulatory bodies and fighting the natural reluctance of the public in their efforts to get rate increases which would enable them to meet rising costs of labor and material, and to pay their security owners a fair rate of interest on money borrowed. While other commodities rose from fifty per cent to as high as four hundred per cent the rates of power companies rose an average of fifteen per cent. Now in a period of retrenchment there are some who are clamoring for a reduction in power rates first, probably reading only one part of their Bible, "* * * the last shall be first." Among this group there is a tendency to call the commissions which in the past have protected them, the hirelings of the power companies. If all commodities reach their pre-war level the worst that faces the industry is a drop of fifteen per cent as against the enormous fall of some others.

"Are we downhearted?" We have the same faith in the industry and in the cause of the right, and we can afford to shout "No!" and give a long cheer.

Higher Pressures in Steam Electric Generation

The modern tendency in the operation of central steam stations is toward higher steam pressure and higher superheat, as brought out by C. H. Delany and W. F. Durand in Electrical World May 15, 1920. Here it was shown that, with steam at 200 lb. pressure and 200 deg. superheat compared with steam at 300 lb. pressure and 166 deg. superheat, a very interesting situation develops, especially since both of these pressure and superheat conditions give the same actual temperature of the superheated steam as 588 deg. F. In such a case it may be observed that while the quantity of heat present in the initial steam in the two cases is practically the same, the heat utilized in the case of steam energy at 300 lb. pressure is about 4% more than in the case of 200 lb. pressure steam. In actual practice these figures would be slightly modified by difference in efficiency of the prime mover under the two different conditions. However, with turbines properly designed for the conditions under which they are to operate, this difference would be small and may be neglected in any practical discussion of the subject.

Already this trend toward higher pressure development is to be seen on the Pacific Coast, as brought out in the article above referred to. Within the last two or three years power plants have been built in this section of the country for boiler pressures of 250 lb., while in the Eastern states plants are already in operation at 300 lb. pressure and pressures even as high as 500 lb. are being talked of as possibilities. The maximum limit to pressures and superheat is determined at the present time by the temperatures that the materials of construction will stand. With present steels 700 deg. F. is about the limit. This limit would be reached at 500 lb. pressure and 230 deg. of superheat. The pressure is also limited commercially by the extra cost involved, as it is possible that in some circumstances the fixed charges on the extra investment required for the high pressure apparatus may neutralize the saving effected.

However, the trend toward higher pressures and higher superheat is the inevitable urge of economic development and to this careful investigation, both in design and operation looking toward higher pressures and higher superheat, engineers and executives may well give ever-increasing attention.

Cooperating with the Manufacturer

The electric manufacturers of the country look to the power men to keep them in touch with the needs of the industry. Where apparatus has proved inadequate, and what new instruments or materials are required—these complaints or appeals, brought out during the papers and discussions of every electrical convention, in large measure direct the channels of research for the coming year. The manufacturers themselves, of course, are always on the lookout for improvements in their equipment and many of the important advances in modern practice are to be credited to their initiative. The engineer in the field and the manager who is planning for extensions and economies, however, are the ones most closely in touch with needs and most capable of foreseeing new possibilities. An example of the practical results to be obtained through such cooperation is to be seen in the development of the oil field motor which was worked out simultaneously by two national manufacturers to meet a California situation whose needs were first pointed out by a power company manager on the lookout for a new market for his output.

Among the needs of the moment which have been recently voiced by the power industry are the development of an oil switch adapted to the larger capacities of modern central stations, and a standardized method of figuring the rupturing capacity of such switches, together with the development of outdoor metering equipment suitable for use by saw mills, irrigating plants and in similar exposed situations common in western experience. It is significant that the manufacturers are already at work in the solution of these problems.

Would not a similar coordination of effort bring about equally satisfactory results in fields other than those of strictly electrical interest? Complete records are not so often kept on the hydraulic side of the generator and in consequence the engineer is not in a position so definitely to analyze his needs in his field. More care in keeping such data would perhaps be productive of effective research work on the part of the manufacturer which would solve some of the problems now embarrassing work in this field. Men of the power industry should not overlook their responsibility in pointing out the way in which progress can most advantageously advance.

The Past Year

In the pages of this issue of the Journal of Electricity an attempt has been made to sum up those events of the past year which have stood out in the electrical industry in the West. These two inches of space we have reserved to talk about ourselves and the work we have done. In the twenty-four issues of 1920 we have tried to record the achievements of the year, to point the way toward better business methods, to suggest the solution of engineering and allied problems, and to work toward the common end which is the welfare of the industry. As this year is drawing to a close we cannot help but feel that we have done our part in the building up of the industry in the past twelve months, that we have made new friends and kept our old ones, and while in some part "we have done those things which we ought not to have done, and left undone those things which we ought to have done" our spirit has always been to do our best. During the next year we hope to profit by the experience of the past and to be of even greater service to our readers by reporting not only the progress made within the industry but also the progress of electricity as a means of increasing production and a labor saving element in all industry, on the farm and in the home.

The Power Situation in California—1920

BY H. G. BUTLER

(The rapidly growing load, especially agricultural and industrial, in California makes the power supply one of the most important concerns in the state. The following survey of the 1920 power situation, with an outline of the projected new sources of supply, is by the Power Administrator of the California State Railroad Commission.—The Editor.)

With the present installation of hydroelectric plants belonging to the interconnected companies, forming a continuous chain from a point fifty miles north of the California-Oregon line to Mexico and serving the industrial and agricultural centers in the Sacramento and the San Joaquin valleys, Southern California, and the coast, the difference in output between a normal year and a dry year amounts to about 350,000,000 kw-hr., approximately 54,000 hp. continuously, 15 per cent of the total output of these plants during 1919.

To generate this energy by steam would take 1,700,000 barrels of oil costing upwards of $3,000,000. This, in itself, would make a dry year rather a serious matter to the power companies and their consumers; but it is much more serious when load conditions and the lack of new developments require the operation of the steam plants practically to full capacity for six months even in a normal year, and as a consequence the difference between the energy output during normal and dry years for those months roughly measures the extent to which consumers will be deprived of power to pump water for irrigation, to run street cars, and to carry on the thousand and one activities dependent on electricity.

Deficient Precipitation

These conditions obtained in the late winter and early spring of 1920. By the middle of February the snow at the high elevations was so scanty it appeared inevitable that every company in the state dependent on hydroelectric power would be unable to carry its own load during the summer. The San Joaquin Light & Power Corporation was even then refusing new business, was shifting load from day to night to increase the load factor on its steam plants, and was taking off load when it could be done without serious injury to the consumer.

As the spring advanced, the outlook for the season became brighter. In the water sheds of the southern group (the San Joaquin Light & Power Corporation and the companies south) late storms brought the precipitation to a point approaching normal, and three additional generating plants under construction were so far advanced that their completion during the summer could be depended upon. In the north (Sierra and San Francisco Power Company and companies north to the California-Oregon line) May arrived with the precipitation farther below normal than at any time since the Weather Bureau records have been kept, but still much better than could have been anticipated three months before.

To meet the situation in the south, load was shifted from day to night during the months of April, May, and June, and new business was taken on only when it was strictly essential. Early in July the San Joaquin Light & Power Corporation completed a 17,000-hp. steam plant at Bakersfield, the city of Los Angeles brought in 23,000 hp. in a new hydroelectric plant, and the 40,000-hp. Kerckhoff plant of the San Joaquin Light & Power Corporation was nearly ready to be put in service. This new power more than made up the shortage, and on July 14 all the restrictions which had been imposed on the southern companies were entirely removed. It was still necessary for them to follow a priority

ELECTRIC PLANTS UNDER CONSTRUCTION IN CALIFORNIA

Company	Capacity in Kw.	Name and Location	Expected Date of Completion	Type
Great Western Power Company	40,000	Caribou: Feather River (2 units)	April, 1921	Hydro
Pacific Gas & Electric Company	12,500	Oakland	January, 1921	Steam
	6,100	Hat Creek, No. 1	April, 1921	Hydro
	8,200	Hat Creek, No. 2	April, 1921	"
	44,300	Fall River	March, 1922	"
	7,500	Spring Gap: Stanislaus River	July, 1921	"
City of San Francisco	49,500	Moccasin Creek (3 units)	January, 1923	"
Southern California Edison Co.	16 500	Big Creek No. 2: 3d unit	December, 1920	"
	30,000	Kern River No. 3	February, 1921 (1st unit)	"
	22,500	Big Creek No. 8	August, 1921	"
San Joaquin Light & Power Corp.	12,500	Midway	April, 1921	Steam (gas fuel)
	8,250	Kern River	July, 1921	Hydro
Southern Sierras Power Co.	2,500	Owens Auxiliary	February, 1921	"
	10,000	Levining Creek	October, 1922	"
Los Angeles Gas & Electric Corp.	10,000	Los Angeles (limited to 7500 kw. account of boilers)	January, 1921	Steam
City of Los Angeles	7,000	San Fernando	January, 1921	Hydro
	2,500	Franklin Canyon	January, 1921	"
Total	289,850			

list in connecting new consumers, and for several months longer those who had their own steam or gasoline plants were refused electric service.

Demands of the Rice Industry in the North

In the north the first move to meet the shortage was made as early as March. The high price of rice for the past three years had encouraged farmers in the Sacramento Valley greatly to increase their acreage for this year, and early estimates indicated that it would be doubled. A large portion of the rice crop is raised by water secured by electric pumping from the Sacramento river and from wells. The load comes on in May and lasts generally for one hundred days—just the time when the stream flows are lowest and the power companies are least able to handle it.

In 1919 the rice industry in the Sacramento valley consumed nearly 37,000,000 kw-hr., and the prospect of furnishing twice that amount of energy for 1920, in the face of existing power conditions, was alarming. Warnings were therefore sent out that the power situation would probably require a reduction in the use of power as against 1919, and growers were urged to reduce their acreage rather than increase it, to make all possible arrangements to conserve water, and to install equipment which would make them independent of the power supply. These warnings were continued until planting time, during the last few weeks in conjunction with the Water Conference Committee organized to see that the best use was made of the water of the Sacramento river which was threatened with depletion by the unusual demand of the rice growers at a time of record-breaking low flow. As a result the acreage planted, although greater than in 1919, was much less than originally contemplated; better use was made of the water, and some 10,000 hp. was installed by the rice growers to care for their own load. Three installations of steam-electric plants totaling 4,000 hp. were made. The rest was in gasoline and Diesel engines.

Restrictions in Northern California

In May, during the night hours, the steam plants were not being worked to capacity, and there was considerable excess power in the hydroelectric plants. In order to utilize this excess, letters were sent to all large users of power asking them to change their hours of operation and make their heaviest demands come after seven p.m. Through the County Farm Advisors the same word was sent to farmers. The result of these requests for shifting load was not all that could have been desired, and later in the month power users, agricultural and others, were required to make this change in their method of operation.

The weather during May and June was cold, and as a result the evaporation of water in the reservoirs and ditches was less than normal and the snow at the higher elevation did not melt as fast as usual. For that reason at the end of June the streams were carrying more water than had been estimated.

Early in August the rate at which the water in the reservoirs was being exhausted, the shrinkage in the flow of the streams, and the breakdown of two or three important steam units which had been carrying continuous overloads for weeks, made it necessary to put into effect far-reaching restrictions on the use of electric power. Sign and display lighting was eliminated five days in the week, street lighting was reduced to a minimum consistent with public safety, street railroads and all other industries, except agriculture, were put on power rations approximating 80 per cent of their normal supply. Agriculture, under the advice and direction of five members of the United States Department of Agriculture and the University of California, who volunteered their services during the crisis, was allotted power in amounts varying from 100 per cent of normal to zero, depending on the use and locality. New business except lighting was almost entirely refused.

Conservation of Water Supply

Before the restrictions were imposed steps were taken to conserve the supply of storage water in power reservoirs, and to augment the sources of supply.

During several weeks in the summer the draught from power reservoirs is governed by irrigation and not by power requirements. The result is that the load factors on the steam plants are lowered and their possible consequent output reduced —practically amounting in times of shortage to a loss of energy. This year engineers were stationed in the irrigated sections below the principal reservoirs to see to it that no water was released for irrigation purposes unless it was absolutely needed. By doing this, and by taking advantage of the diversities in the irrigation requirements between different sections, as well as the diversities in load between companies, it was possible to use the water for the dual purpose of power and irrigation to the best advantage.

To increase the supply of water several water rights were purchased or rented on tributaries of streams developed for power. Many acres of land in the northern counties were deprived of water for irrigation through such arrangements in order to increase the power output.

Interconnection and Augmented Power

Every effort was made to bring to the consumers, through the power companies, power from other sources which are not ordinarily used. In the first place, every steam generating plant owned or controlled by the power companies was operated regardless of the cost of the output. An interconnection between the San Joaquin Light & Power Corporation and the Pacific Gas & Electric Company was completed, through which some 2,000 hp. was delivered to the northern portion of the state. Arrangements were made so those who had private plants would

DO YOU REMEMBER

—that in 1898 San Francisco ranked third among the cities of the world in the use of electricity per population, based upon figures of central station output?

operate them and reduce their demand on the power companies accordingly. Any excess these plants had was absorbed by the companies. The municipal steam plant of the city of Alameda, the Diesel engine plant of the city of Palo Alto, steam and hydroelectric plants of mining, sugar, lumber and oil companies, electric railroads, irrigation districts, and other industries, all contributed their surplus power to relieve the shortage.

Past Conditions and Future Outlook

If the weather conditions in the fall of 1920 had been similar to 1919 the power shortage would have continued from August, when restrictions were first imposed, until well into the new year. As it was, rains early in October replenished the streams and lightened the load so that the restrictions could be gradually removed, and by the middle of the month conditions were again normal.

The northern portion of the state went through a power shortage in 1918, narrowly missed one in 1919, and suffered again in 1920; fortunately not as severely as conditions in March indicated, thanks to favorable weather in the late spring and early fall, but still severe enough to have a hampering effect upon industry. The southern portion was on the verge of the shortage in 1918 and 1919 which actually materialized in 1920. The power situation of the state is therefore one which cannot be looked upon in retrospect with any degree of satisfaction. It is more cheerful to look ahead.

There are under construction at the present time seventeen projects which will increase the generating capacity of the state 390,000 hp. Of these fourteen are hydroelectric with a capacity of 340,000 hp. All of them will be in operation by 1923, and probably by that time many more in contemplation will have been started and put in operation. In 1921, unless present plans go far awry, commencing in January one plant after another will be completed until 240,000 hp. has been added to present capacity; a fairly satisfactory guarantee that next year there will be an abundance of power for all consumers both present and prospective.

High Voltage Research Equipment

BY HARRIS J. RYAN

(In the field of electrical research great advances have been made during the past year and much valuable work accomplished. Following is a description of some of the equipment in the high-voltage laboratory at Stanford University where Professor Ryan of the electrical engineering department has been carrying on extensive and productive research work. This work is of especial interest in the West in view of the recent record advances in high voltage transmission.—The Editor.)

The frontispiece of the present issue of the Journal of Electricity is a reproduction of a photograph of a high voltage oscillator in action. The discharges to the opposing grounded electrode are 111 inches in length. The length can be authenticated by using a scale made from the fully extended 72-inch folding "pocket rule" that is seen in the photograph hanging from the discharging electrode of the oscillator.

In establishing a high voltage laboratory for university needs this oscillator was developed for the purpose of authenticating routes of discharge produced by impulsing super-voltage through large air columns between opposing electrodes in the clear or about intervening insulators. In so doing the following elements were adopted: a condenser made of thirty common window glass plates with electrodes of light weight sheet tin, 20 by 20 inches, immersed in transformer oil; a primary discharge-interrupter gap between rotating cast-iron wheels similar to the corresponding gap used in Creighton's oscillator, except that an air blast having a velocity-head equivalent to a 5-inch water column has been added; the oscillator, proper.

The primary and high voltage secondary coils of the oscillator are formed and mutually related in their mounting, as may be seen in the photograph. The low voltage primary contains a maximum of 12 turns. They are bare, air-insulated, and form an inverted frustrum of a cone to accomplish close coupling with the low potential portion of the secondary without overstressing the intervening air. They are made up of No. 0000 B and S G, 7-strand hard drawn copper cable.

Big steps in tuning the oscillator are taken by cutting in or out single turns from the fixed portion of the primary that contains **ten** of the **twelve** turns. The two remaining turns are given a flexible mounting below the rest. Exact tuning is accomplished by moving them up to or down from the fixed turns. When the oscillator is operated "unloaded" as in the photograph, **seven** fixed turns and a certain position of the floating coils will produce exact resonance, i. e., exact equalization of the frequencies of the primary and secondary pendulums. When the oscillator is overloaded by connecting the high voltage terminal of the secondary to 20 feet of 1-inch tubing as a line conductor suspended in the middle from a double 13-unit suspension insulator string and ended with a corona-preventing, 3-foot sphere in tuning it is necessary to add some inductance at any convenient point in the primary circuit. A few turns of conductor 20 inches in diameter suffice for the purpose. The exact number is determined by trial in each case.

An essential feature of the oscillator is the sphere, 4 feet in diameter, that serves as the main terminal and high voltage secondary condenser. It is dimensioned and formed strategically to prevent waste of energy by corona formation. The energy released from the primary condenser must be conserved to apply in the production of the desired dis-

charges; likewise to prevent the air that surrounds the secondary coil from over-stress under all operating conditions. The single layer secondary coil is mounted on a redwood cylinder, 10 inches in diameter and 48 inches long. The coil proper has a net length of 46 inches and contains 1250 turns of No. 24 B and S G double cotton covered magnet wire. The condenser terminal construction is further revealed by the photograph. The greatest depth of air column insulation between the high and low voltage terminals is 39 inches. This suffices because of the structural strategy employed to withstand satisfactorily the voltage required to develop 111-inch discharges through the air between the discharging and opposed grounding electrodes. The form of the electric field from the sphere and secondary coil to the ground is such throughout that ions have to travel virtually at right angles to the field to reach any vital portion of the oscillator. That they cannot do. They are formed by overstress of the air at the discharging electrode and with turbulence are driven violently outward in the direction of the field.

From the dimensions given the capacitance of the primary conductor can be computed. It is charged generally at 15,000 volts, 60 cycles, through some inductance-resistance protectors for the source transformer. One can also compute approximately the inductance of the secondary and its oscillating frequency. From these values after making a fair allowance for losses occurring in the primary gap-discharger the energy delivered to the secondary is revealed and the value of the secondary current can be calculated. The voltage generated when flashes are not permitted to reduce the energy present in the secondary pendulum is then given by the relation:

$$e = 2\pi fLi$$

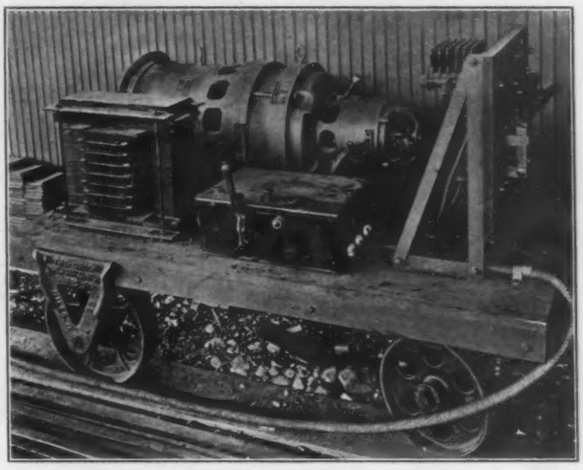
As the flashes are allowed to develop, the oscillating energy in the secondary is diminished with a corresponding diminution of voltage developed. After making reasonable allowances for the losses specified above, the residual energy thrown into the secondary pendulum is thus estimated to develop about 2,500,000 volts, effective, when no flashes are formed. Flashes are always allowed to develop, for the insulating air columns, at their best, can not withstand the stress produced by such high voltage "to ground." The voltage is, therefore, always limited by the amount of energy expended in the flashes or discharges that are formed. The action automatically limits the length of flashovers that can be produced. Such length in the present oscillator varies between the limits of 8 to 10 feet. At 10 feet, assuming an impulse ratio of 1.5 over corresponding sustained 60 cycle action and 10,000 volts per inch for the latter, the voltage required to produce a 111-inch flash-over is estimated to be 1,660,000 volts, effective, which is about what one would expect from the values and relations given above. It is a reasonable assumption, therefore, that the value of the voltage which produced the discharges and which appear in the photograph was not far from 1,500,000 volts, effective, to ground.

RECENT DEVELOPMENT IN MACHINES FOR ELECTRIC ARC WELDING

In the Journal of Electricity of March 1, 1919, there was an article describing the types of machines then in existence for use in producing the arc in arc welding operations. Since that time, the whole country has seemed to take a greater interest in arc welding, and most of the manufacturers have made improvements in their standard machines. Some have found it possible to adopt a more compact form, and yet maintain the efficiency of the set, while others have brought forward new types of machines.

While all agree that the operator is the most essential factor in arc welding, and must bear the greatest responsibility for its success or failure, yet it is also as universally agreed that the stability and the quality of the arc must be maintained.

There still exists differences of opinion as to the best method of producing the arc, but from the machines put on the market since the article in the Journal of March, 1919, was written, would seem to indicate that the variable voltage type of machine is gaining in prominence. When the said article was



A self-contained one-man arc welding outfit which marked a distinct advance over earlier types

written it mentioned one known type of variable voltage set, at that time actually on the market, and two types which were being developed. Today there are four manufacturers manufacturing this type of machine; the first and the longest in the field is the Lincoln Electric Company of Cleveland, Ohio, with several varieties of machines to meet varying conditions; the second in the field is the U. S. Light and Heat Corporation of Niagara Falls, N. Y., who also make a line of similar machines; the General Electric Company and the Westinghouse Electric & Manufacturing Company have also a line of this type of machine included in their standard equipment.

DO YOU REMEMBER

—the incorporation of the first central station in San Francisco by G. H. Roe on June 30, 1879? The first plant was a wooden building which burned down later and machinery was stopped at midnight.

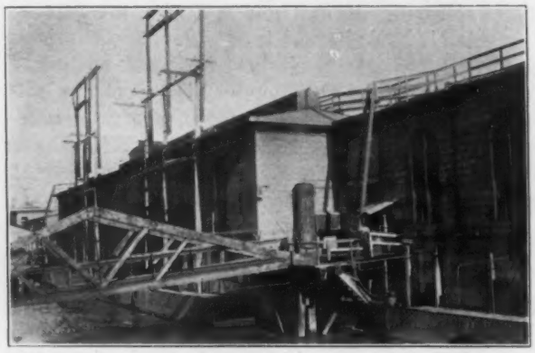
Early Records in Western Power Development

The old San Antonio plant of the San Antonio Light & Power Company, at Pomona, territory now served by the Southern California Edison Company. This plant, built in 1891, was the source of power for the first long distance transmission line in the world—28 miles at 10,000 volts.

Plant No. 1 of the San Joaquin Light & Power Corporation, 1450-kw. capacity, was placed in operation in 1896 with a static head of 1410 ft., the highest head then in America. The thirty-five mile transmission line, carrying power at 11,000 volts into Fresno, was the longest then in existence.

Viewing the lower Spokane Falls, Washington, in 1884 previous to the power development. The old Spokane Falls plant, completed two years later by the Washington Water Power Company, was built on this site which is now in the center of the city of Spokane. The first hydroelectric plant of any size built to supply a city.

Rome power house, on the South Yuba river, built in 1895 by the Nevada County Electric Power Company, later absorbed by the Pacific Gas & Electric Company. The plant had two 240-kw. units operating under a 190-ft. head, and delivering 550 hp. to Nevada City over a 5000-volt line.

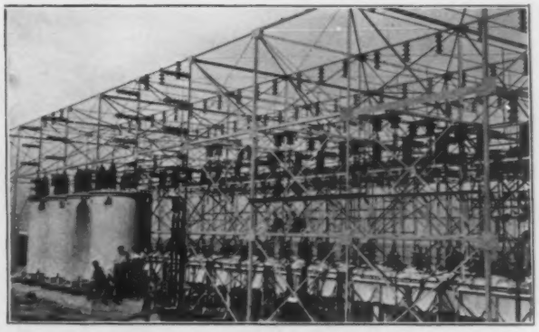


An early hydroelectric plant at Oregon City, on the system of the Portland Railway, Light & Power Company. The plant was tied in with another and used a system of bells for starting the generators simultaneously. It is still in existence, generating at 30 cycles as formerly, but converting to sixty.

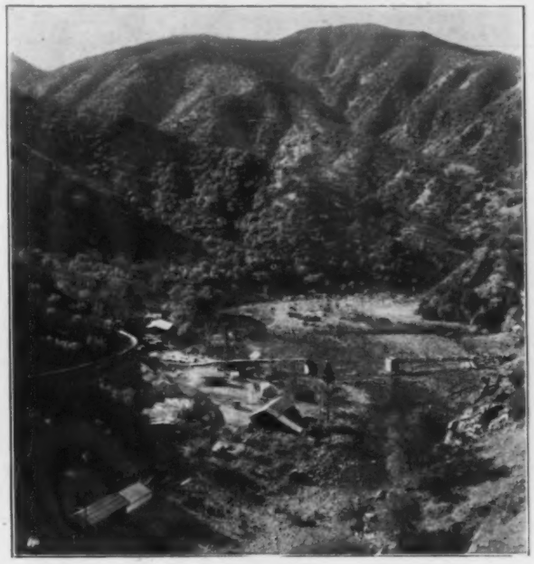
Plans for the Electrical Future

The site of the proposed dam to be constructed across the Colorado River as a part of the hydroelectric development of the Southwestern Industrial Company. The dam will be 120 ft. high, backing the water up for fifty-six miles, and storing 1,500,000 acre-feet of water. The ultimate installation will be 10 units of 12,500-kva. each, generating 140,000 hp.

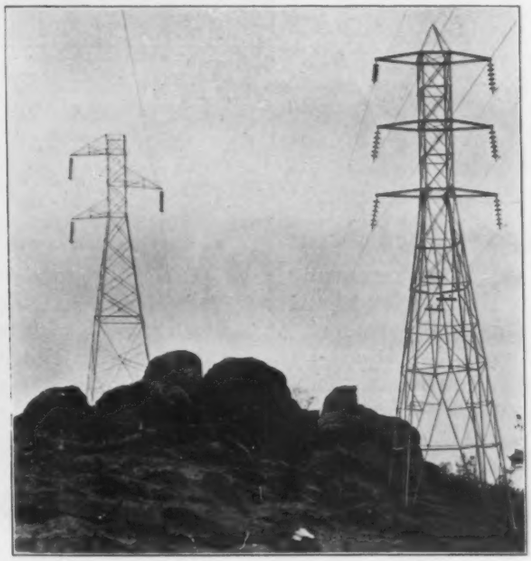
Pouring the foundation for the draft tube at Hat Creek Power House No. 1, on the Pacific Gas & Electric Company's Pit River project. The ultimate development will be about 400,000 hp., power being transmitted 220 miles at 220,000 volts.



View of the recently constructed 60,000-volt switch rack of the Vestal Substation, Southern California Edison Company, near Porterville, California. The picture shows also the 5,000-kva. transformer for the 60-cycle end of the frequency changer.



General view of Camp No. 13 on the Kings River project of the San Joaquin Light & Power Corporation, looking down the North Fork. This project will have an ultimate output of between 270,000 and 300,000 hp. and will cost about $55,000,000.



On the right is shown the double circuit, 110,000-volt Las Plumas line of the Great Western Power Company, and on the left a valley type tower on the single circuit, 165,000-volt Caribou line which is to break the present world's record, transmitting power at 165,000 volts.

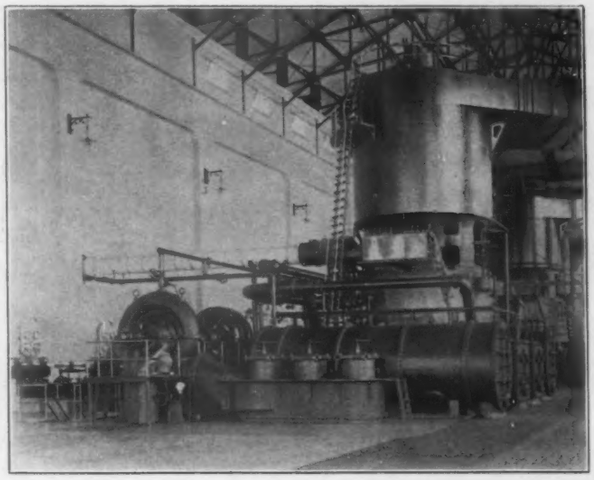
Fuels of the Pacific Coast

BY C. H. DELANY

(The benefits of the power shortage might be hard to point out to the engineer in charge of hydroelectric operation but to the engineer in charge of steam generating plants the power shortage meant operation under extremely difficult conditions which gave him an opportunity to study overload conditions for a prolonged period. The increased cost of fuel oil made imperative the search for greater economies in the use of this fuel and for new fuels. The outstanding features of the fuel situation on the Pacific Coast for the past year are outlined in the following article by the assistant engineer of operations of the Pacific Gas and Electric Company.—The Editor.)

The outstanding feature of the fuel situation on the Pacific Coast, during the year 1920, has been the growing scarcity and increasing price of fuel oil. The problem would be a simple matter were coal as plentiful on the Pacific Coast as it is in the eastern and middle western states. In California, unfortunately, coal is much more scarce than oil. Except for three or four mines containing a poor quality of lignite, none of which are now in commercial operation, there is no domestic coal available. All coal used in the state must therefore be transported from a distance, with the result that the cost of coal delivered at the plant is excessive.

With the scarcity of these two fuels staring us in the face, it is not surprising that the engineers of the Pacific Coast are turning their attention more and more to the unending supply of "white coal" that is always available in the mountains. Thus we find greater activity than ever before in hydroelectric developments. The power companies contemplate generating larger and larger proportions of their output by water power, and manufacturing plants are turning more and more to power companies for the necessary energy to keep their wheels turning. There are many factories, however, which require steam or heat in some form in their processes and they must burn fuel to produce it, so that even if the hydroelectric developments succeed in catching up with the demand for power, there will always be an independent demand for fuel.



"A friend in need is a friend indeed" might aptly be applied to the steam standby plants which must be ready at all times to pick up the load dropped by the hydro plants in time of trouble. The extent to which these plants have been forced during the past three years, due to the shortage of water and the increased demand for power, is unprecedented. The illustration shows two of the big turbines in the Long Beach plant of the Southern California Edison Company.

Greater Efficiency in Oil Burning Demanded

The scarcity of oil, besides arousing interest in other kinds of fuel, has stimulated in a marked degree the demand for more efficient methods of burning oil. Interest in efficient operation was given added zest by the recent power shortage, when the quantity of oil burned for electric generation was greater than ever before. This led to the forcing of boiler plants to a maximum, and the necessity of securing good efficiency even at high overloads, was marked.

Perhaps the greatest development in oil burning during the year 1920 has been the introduction into stationary practice of the method of atomizing the oil that has proved so successful in marine practice, namely, mechanical atomization.

It has been found that in a furnace of a given size, a greater quantity of oil can be burned when mechanical atomization is used, than when the atomizing is done by steam. The natural result of this is that, for a boiler with a given furnace volume, it is possible with mechanical atomization to burn larger quantities of oil in the furnace proper; or, in other words, complete combustion may be obtained, even at high capacities, before the gases come in contact with the boiler tubes. With steam atomization this is also true at normal rating, but at high capacities complete combustion is not obtained before the gases are chilled by contact with the boiler tubes; so that, while the efficiency at normal rating may be as high as 81 or 82 per cent, it gradually falls off as the capacity increases, dropping to about 74 per cent at 200 per cent rating. With mechanical atomization, on the other hand, it has been found by tests that it is possible to maintain efficiencies over 80 per cent clear up to 300 per cent of the boiler rating. It thus appears that a real advance in the art of oil burning in stationary plants has been made during the past year.

Undeveloped Coal Deposits

Coal is used quite extensively in the Northwest, where there are considerable deposits of bituminous and sub-bituminous coal and lignite. While much of the coal available is of a fairly good quality, there are much larger deposits of very low grade coal or lignite, not yet developed. It is difficult to burn these low grade coals on any form of stoker and secure good efficiency. When burned in the pulverized form, however, the efficiency obtained is almost as high as with the better grades of coal. For this reason, pulverized coal has made good progress in the Northwest, where coals containing as high as

30 to 35 per cent ash have been successfully burned. Efficiencies as high as 75 per cent have been obtained, and where the furnace is of ample proportions it is possible to operate up to 200 per cent of the boiler's rating.

Natural Gas

Natural gas, which is superior to all other fuels as regards flexibility and ease of operation, occurs extensively in the California oil fields. The San Joaquin Light & Power Corporation is operating a steam plant in Bakersfield fired by natural gas, which is piped into town, and is building an additional plant near the oil fields where the supply of gas is abundant. The heating value of natural gas runs from 930 to 1040 B.t.u. per cu. ft., so that one barrel of oil is equivalent to about 6,000 cu. ft. of gas. If the gas can be purchased for, say, 14 cents per 1,000 cu. ft., it is equivalent to oil at 84 cents per barrel. Unfortunately natural gas is not available for power purposes in the large industrial centers. If it is brought into a large city, it immediately becomes so valuable for domestic uses as to place it out of reach of the steam plants.

Refuse As Fuel

Refuse from certain industrial establishments is used as fuel wherever it is available in sufficient quantities, and has high enough heat value to warrant the installation of the necessary equipment. By the use of refuse as fuel not only is the purchasing of new fuel saved, but also the expense of disposing of the refuse is eliminated.

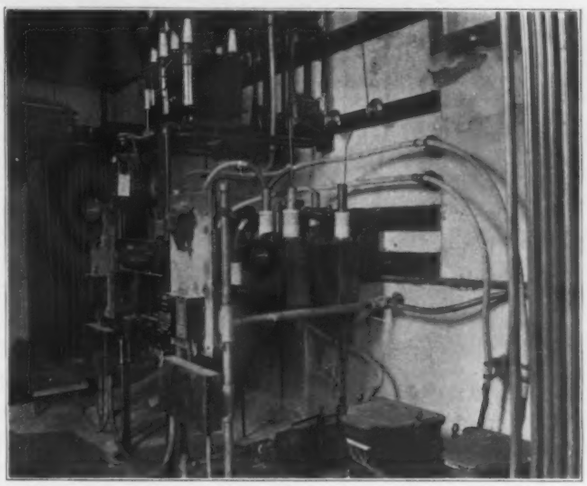
The refuse from oil refineries is by far the most important of these fuels, for it is possible to consider fuel oil in this category. Fuel oil is the product that remains after the more valuable lighter oils, such as gasoline and kerosene, are distilled off from the crude petroleum. Indeed the present scarcity of fuel oil is due in part to the progress made by the oil refineries in methods of producing gasoline, and the recovery of greater and greater proportions of the crude petroleum in the manufacture of this commodity. In fact, some of the most up-to-date refineries are now producing a residue entirely different from fuel oil, but which will undobtedly become a valuable fuel when suitable storing and burning methods have been evolved.

Saw mill refuse, consisting of sawdust, chips and small blocks of wood, is the universal fuel in the lumber industry. Most lumber mills produce more of this fuel than is required for their own boilers, and it has heretofore been the custom to destroy the surplus in large burners. Where the lumber mill is in proximity to other industries, this fuel can be distributed and becomes a valuable source of cheap fuel. Public utilities in Portland, Oregon, are using sawmill refuse, hogged fuel, for the generation of electric power. The fuel contains a great deal of water, 35 or 40 per cent, but it burns satisfactorily in Dutch oven furnaces of large volume, being fed to the furnaces by conveyors through openings in the furnace roof. The fuel piles up on the grates in conical form, and burns around the edges where the fuel bed is thin, while the main body of the cone is drying out. Owing to its bulk, sawmill refuse is difficult to transport and to store, so that its use is limited to plants in the vicinity of lumber mills.

Tan bark, by which is meant the spent tan or refuse remaining after the tannin has been extracted from the bark in the leaching process, is a fuel used for steaming purposes in tanneries. It is finer and contains more moisture than sawmill refuse, usually running about 65 per cent moisture, and is therefore more difficult to burn. It can be burned with good results in a properly designed Dutch oven, provided with strong induced draft. As tanneries require a great deal of steam in their various processes, the tan bark available is not sufficient fuel for their own needs, and consequently there is none on the market for other users of fuel.

Another fuel that is very limited in its supply is the refuse from oil gas works, commonly called "lamp black." This is a fuel of high heating value, containing over 14,000 B.t.u. per pound dry and less than 2 per cent ash, but as it is removed from the gas generators in washers, it becomes saturated with water, and on reaching the fire room, it contains from 50 to 70 per cent of moisture. This fuel contains a good deal of tar, and is sticky and difficult to handle. It is fired by hand and burns brightly and easily, notwithstanding the high water content. Best results are obtained with a thick fire and extra large grate surface is necessary if the boilers are to be operated at high capacity.

TRANSFORMER FOR BRASS FURNACES



The above is a corner of the transformer vault in the foundry of the Oregon Brass Works, Portland, Oregon. The 300-kva. transformer supplies current to the 2000-lb. brass furnace. The two small transformers in the foreground supply three-phase current for the rocking motors.

DO YOU REMEMBER

—that in 1895 long distance transmission was regarded as an experiment and a long treatise appeared in one of the technical magazines questioning the possibility of ever locating the plant at a distance from the consuming market?

New Transmission Line Construction in 1920

BY H. A. BARRE

(Transmission of power at 220,000 volts is not yet an accomplished fact, but it has been definitely nearer during the past year. The following article reviewing some recent transmission achievements is by the electrical engineer for the Southern California Edison Company. —The Editor.)

The most interesting feature of transmission line development during the year 1920 has not yet reached the stage at which it would ordinarily be considered an achievement, and thus be properly included in the Retrospection Number of this Journal. Nevertheless it is of such great importance that it should be given a prominent place in our consideration of the year's work.

Rapid Growth of Ideas

Slightly more than a year ago when Messrs. Sorensen, Cox and Armstrong presented their paper on the California 220,000-volt bus at the Pacific Coast Convention of the A. I. E. E., the subject was not given very serious consideration by many of the delegates. Today plans are well under way for the actual construction of the greater part of this bus, the northern and southern ends, and the gap between these two sections is actually bridged by large capacity inter-connections of lower voltage. Some of the delegates who were least inclined to give favorable consideration to the 220,000-volt bus idea were representatives of the companies which are now constructing these lines, and are parties to the inter-connections referred to. This is of interest only to show how the thoughts and the plans of our Pacific Coast engineers have advanced during the past year.

This advance has been forced upon us by necessity. In the case of the Southern California Edison Company, the Big Creek lines at 150,000 volts will be loaded to the maximum limit of approximately 120,000 kw. by the spring of 1922. After that it will be necessary to provide more transmission capacity before additional generating units can be put into service at Big Creek. The capacity can be doubled, either by constructing two more 150,000-volt lines, or by raising the voltage on the present two lines to 220,000 volts. The first plan would cost from $2,000,000 to $15,000,000, while the second would cost from $2,000,000 to $3,000,000.

Experiments on Insulation

Plans for increasing the voltage of the present lines to 220,000 volts are rapidly taking form. The work of Professor Ryan at Stanford University on the voltage distribution and flashover characteristics of long strings of insulators has shown beyond a doubt that line insulation for voltages of this magnitude can be provided successfully by the use of the standard insulators of today. Plans for energizing a 30-mile section of one of the Big Creek lines have been made. This section will be insulated with standard ten-inch cap and pin suspension insulators arranged in various forms to suit the clearance conditions required at different towers and different positions on the towers. This section of line will be energized through a bank of three 4500-kva. transformers, connected in delta on the 60,000-volt side and star on the high tension side, which will give a possible variation of line voltage from 206,000 to 272,000 volts. While it is realized that this short section of line, open at one end and carrying no load, will not show operating characteristics the same as those of a long line over which power is being transmitted, it is hoped that some information in regard to proper insulation will be obtained. After this experiment has been completed, the next step will be to convert one of the circuits for commercial operation at 220,000 volts.

The equipment for the first unit of the Big Creek Power House No. 8 has been purchased with characteristics suitable for either 150,000 or 220,000-volt operation. This equipment will be installed by the middle of 1921. The transmission voltage will not be raised to 220,000 volts until one or two years later.

The changes necessary at the terminal stations present a large problem in themselves. Various schemes for accomplishing this are now before the manufacturers for their consideration. The manufacturers are confident of being able to make successful apparatus for 220,000-volt operation. The question is, which of various ways of changing from 150,000-volt operation to 220,000-volt operation is the best.

The actual carrying out of these plans will be accomplished during the next one or two years.

New 60,000-Volt Construction

There have been no particularly striking achievements in actual construction of transmission lines on the Southern California Edison system during the year. Practically all the transmission line construction has been on 60,000-volt lines.

The most important line constructed is the Kern No. 3-Vestal line which connected the new Kern No. 3 Plant of 32,000-kw. capacity with the Big Creek lines at Vestal, a new substation built for this purpose, and for the further purpose of tying the 50-cycle system of the Southern California Edison Company to the 60-cycle Mt. Whitney system of that same company, and the 60-cycle system of the San Joaquin Light & Power Corporation. Vestal is almost due west from Kern No. 3 and is between the towns of Richgrove and Ducor. The line is nominally a 60,000-volt line, but the actual voltage will be approximately 75,000 volts at the Kern No. 3 end and 70,000 volts at the Vestal end. It consists of approximately 37 miles of single steel tower line carrying two circuits, and six miles of double wood pole lines, each carrying a single circuit. The conductors are of 4/0 copper and a steel ground wire is carried above the conductors the entire 43 miles. The dead end insu-

lators consist of six 10-inch cap and pin suspension units and the suspension insulators consist of five units of the same type. This line passes over the Greenhorn Mountain at an elevation of 6200 feet, the Kern No. 3 and the Vestal ends being at elevations of 2600 feet and 450 feet respectively.

Approximately 86 miles of the so-called Mt. Whitney loop has been replaced with an entirely new 60,000-volt line this year. Previously this loop was a 30,000-volt line, but the rapidly increasing load made it necessary to change all but the northern end of it to 60,000 volts. The new line makes a 60,000-volt loop to which the remaining portion of the old 30,000-volt loop is connected by 60,000/30,000-volt transformers at Lindsay and Tulare.

There are two points of interest in regard to the construction of this line. The first is the ease of framing the pole tops. No gains were cut, thus reducing the work on the pole itself to the boring of holes for two through bolts.

A Successful Hole-Boring Machine

The second point of interest is the manner of digging the holes. A hole-boring machine was purchased and has proved very satisfactory. This machine will dig a hole 24 inches in diameter and 8 feet deep, 7 feet of which is through "hard pan," in 13 minutes, and the best time made for a hole of this size where the ground was more favorable, was a little less than two minutes from the time boring was started until the hole was completed. In some cases the "hard pan" has been so hard that a cloud of smoke rose from the hole while the bit was in operation. Three or four holes through material of this type make it necessary to sharpen the bit. This is done by replacing the cutting edges and sharpening the worn ones for subsequent use.

The boring machine is mounted on a turn-table which is bolted to the bed of a five-ton, four-wheel-drive truck, equipped with pneumatic tires and designed for a speed of fifteen miles per hour. The turn-table allows the machine to be swung through approximately 270 degrees, and the tower which carries the augur can be tilted forward or backward to any angle up to 36 degrees from the vertical.

There is a pole-raising derrick mounted on the truck. It is independent of the turn-table, and will operate to the rear of the truck only. The derrick is of 5,000-pound capacity and of sufficient height to handle a 40-foot pole. A derrick of sufficient height to set a 60-foot pole is being designed to replace the present one.

When boring holes only, the outfit is operated by two men, one in the truck cab to handle the truck and the power plant and the other on the ground to control the augur and direct the movements of the truck. Power for all operations is supplied by the truck engine.

In boring a hole the augur is driven down until it is covered with dirt. Then its rotation is stopped and it is pulled out of the hole. Then its rotary movement is started again and the dirt is thrown into a circular pile around the hole. Only in very dry loose dirt has it been found necessary to do any hand shoveling away from the hole. In places where poles have to be put over fences or across ditches, the derrick has been used to great advantage.

Other Transmission Improvements

Two other 60,000-volt lines of considerable importance which were built during 1920 are the Castaic to Saticoy line, 41 miles long, and the Serman to Long Beach line, 28 miles long. The first of these provides duplicate transmission service to Ventura county and Santa Barbara. The second provides a 60,000-volt connection between the steam plants south of the big load centers and the 60,000-volt lines north of these load centers. In fact, it completes a 60,000-volt loop around the load centers located in and adjacent to the city of Los Angeles. These lines are of standard single circuit pole line construction. In addition to the lines mentioned above, only a few miles of 60,000-volt lines were constructed during the year.

THE SKAGIT RIVER DEVELOPMENT

BY C. F. UHDEN

(The waterpowers of the Northwest are among the most abundant sources of power this side of the Rockies. The Skagit river project, with an ultimate possible development approaching 500,000 hp., is here outlined by the engineer in charge.—The Editor.)

The Pacific Northwest today is in no better position, so far as the shortage of electrical energy is concerned, than is any other part of the United States. Especially is this the case in western Washington, where at the present time it is impossible to obtain electric current from any source in the district, all the steam and hydroelectric plants being loaded to their full capacity and some current being supplied from British Columbia as well as from the Washington Water Power Company at Spokane.

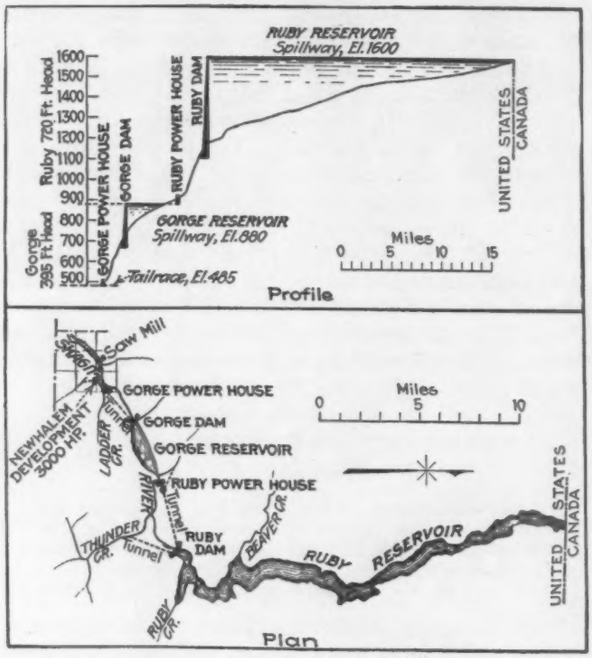
With the object of augmenting the available power supply, Seattle under the supervision of its City Engineer, Mr. A. H. Dimock, has made a complete study and survey of the power possibilities of the surrounding district and has chosen as the most feasible and profitable the development of the Upper Skagit River where an ultimate development of approximately 500,000 hp. can be obtained.

The Skagit River rises in British Columbia, somewhat southerly of a line joining the towns of Hope and Princeton. Flowing first in a general southwesterly and southerly direction, it crosses the International Boundary some seventy miles east of Bellingham, and picks up Ruby Creek at Ruby, some twenty-five miles below the boundary line; continuing southwesterly for another thirty miles, it picks up the Cascade River at Marblemount, the Sauk River at Rockport and the Baker River at Concrete, and thence flows due west for forty miles to the town of Sedro-Woolley. Ten to fifteen miles southwest of

DO YOU REMEMBER

—when transfers were first adopted 25 years ago it was feared they were a failure, owing to the corrupt nature of the passengers who sold them to the newsboys?

Sedro-Woolley, it empties into Puget Sound through the many-mouthed Skagit Delta which comprises the eight-mile stretch of shore line between LaConner and Milltown.



Profile map and plan for the proposed 500,000-hp. development of Upper Skagit River. This river drains an area of more than three thousand square miles of which the Skagit project will develop the entire upper third.

The Skagit River, then, is one hundred and fifty miles long, and drains an area of more than three thousand square miles. Of this three thousand-mile area, the Skagit River Project will develop the entire power of the upper third which lies between two mountain ranges of the Cascades. The main range or divide of the Cascade bounds its catchment area on the east and the range of which Mt. Baker is the best known peak constitutes its western boundary. The run-off of approximately twelve hundred square miles will be utilized through a total fall of approximately eleven hundred feet.

The flow of the Upper Skagit River varies from 800 cu. ft. per sec. at low water to about 50,000 cu. ft. per sec. at high water period, an average flow throughout the past ten years of approximately 3,575 cu. ft. per sec.

It is the intention of the city to utilize ultimately, as nearly as is practicable, the entire flow through the total available head. This will be accomplished by means of two plants, one in the vicinity of Stetattle Creek and one in the vicinity of Ladder Creek, the former having a dam just below the junction of Skagit River and Ruby Creek and the latter having a dam just below the outlet of Gorge Creek.

The waters of Thunder Creek will be utilized by means of a tunnel connecting it with the Ruby Dam, and the waters of Stetattle Creek will also be carried in a tunnel terminating at the surge tower just above the plant.

Extensive diamond drilling has been carried on at the two dam sites showing solid rock of exceptional quality, known as gneiss, at a maximum depth of 110 feet at the Gorge Dam site and at a maximum depth of 30 feet at the Ruby Dam site. These drillings show only a moderate amount of excavation, as the channel in both cases is narrow and has rocky cliffs on both sides extending several hundred feet above the present water surface.

The Ruby Plant, constituting the upper development, will consist of a dam approximately 450 feet in height, a tunnel 17,000 feet in length of about 600 square feet section, and an ultimate installation of six 45,000-kva. units operating under a head varying from 720 feet to 470 feet.

The available capacity of the Ruby Reservoir, whose surface elevation will be 1600 feet above sea level when full, will be approximately 1,000,000 acre-feet and will at times be drawn down to an elevation of 1350, a difference of 250 feet, causing the variation in head at the Ruby Plant above referred to.

The ultimate development of the Gorge Plant will consist of a dam 240 feet in height, two tunnels 11,000 feet in length of 300 square feet area, and six 30,000-kva. units operating under a head of 395 feet.

Not having any available power for construction purposes within a reasonable distance of this development, it was decided to put in a 3,000-hp. hydro-electric plant on Newhalem Creek. This stream has a maximum flow of about 500 cu. ft. per sec. and a minimum flow of 40 cu. ft. per sec. This plant will consist of a small crib dam, 2,720 feet of 5 ft. by 7 ft. tunnel, 700 feet of steel penstock and a 3,000-hp. Pelton Impulse Wheel, direct connected to a 2,500-kva. Westinghouse 6,600-volt generator, and will operate under a head of 500 feet.

Rockport, located on a branch of the Great Northern, is the nearest railroad point and is 23 miles distant from the Gorge Power House. On account of the large tonnage that will be handled, it was decided to build a railroad from Rockport. This railroad is now under construction and will in all probability be completed to the Gorge Plant by March, 1921.

At present all supplies and materials are being transported by three 10-ton Holt Caterpillars and six 5-ton Troy Trailers.

The tunnel for the Newhalem Plant is now being driven and it is hoped to have the plant in operation by next April. A saw mill of 25,000 board feet capacity has been put in operation, which supplies lumber for the temporary camp. This camp will consist of some 75 three-room cottages to be used by the married men, 6 bunk houses of 12 rooms each, capable of housing 24 men each. Also bath houses, commissary, warehouse, hospital, mess house, etc.

The energy will be conveyed at 150,000 volts over a transmission line of about 100 miles in length, with wooden pole structures. It is hoped that energy from the Gorge Plant, which is the first to be developed, can be utilized by the city of Seattle some time during the year 1923.

Pacific Coast N. E. L. A. Committee Activities

(The work of the National Electric Light Association includes the most important group activities of the electrical industry. The following account of the work planned for the coming year by the Pacific Coast Section gives some idea of the constructive program and wide scope of this organization.—The Editor.)

The work of the Pacific Coast Section N. E. L. A. in which is centered the interests of the electrical industry of California and the Pacific Southwest is not by any means confined to convention periods, but continues in the active work of its committees throughout the year. All the major groups of this year's organization are now in full working order and the scope of next year's plans is already well outlined.

The time and place of the next convention of the Pacific Coast Division, N. E. L. A., have been set for May 25, 26 and 27, 1921, at the Hotel Del Monte. The question of program arrangement and the relative importance of business and entertainment features have been under discussion by the executive committee, who are considering the possibility of confining sessions to the morning hours, leaving the afternoons free for recreation. The adjustment of finances between the national and coast organizations is the major problem of importance before the executive body, involving as it does not only the regular expenses for the western division, but also the question of traveling expenses of delegates to national committee meetings.

Lee H. Newbert
Pres. Pacific Coast Sec., N. E. L. A.

The work of the Public Policy Committee has been carried out under the chairmanship of John A. Britton, vice-president and general manager of the Pacific Gas & Electric Company, and while the committee has not held any meetings it has had a representative present at the meetings of the other committees to assist in all matters dealing with public policy. While this committee during the year stands ready to act in an advisory capacity on subjects of policy its main duty is to sum up for presentation at the annual convention the progress of the industry as a whole and particularly the central stations. In this annual report recommendations are also made regarding matters of policy which should be adopted—policies which have become obsolete due to a change in conditions, and when necessary a change in policy to meet new conditions brought about by the growth of the industry, customer ownership of securities or any of the other factors which the industry is continually meeting.

John A. Britton
Chairman Public Policy Committee

The local public relations committee, which corresponds to the national committee of that name, has been organized this year with R. H. Ballard, vice-president and general manager of the Southern California Edison Company, as chairman and already has held several meetings of importance. The work of the committee has been divided into three subdivisions, S. M. Kennedy heading the work of the sub-committee on public information which is charged with questions of contact between the press, the public and the power companies, while W. E. Creed is chairman of the group studying company relations with employes. The subject of the relations which should exist between public utilities and regulatory bodies for the time being is left in the hands of the general committee.

R. H. Ballard, Chairman,
Public Relations Committee

The engineering committee under the chairmanship of L. M. Klauber, general superintendent of the San Diego Consolidated Gas and Electric Company, has undertaken a program of important research work. Papers have been planned for discussion at the spring convention along comprehensive lines.

L. M. Klauber
Chairman Engineering Committee

A series of descriptive papers covering the major power developments in the Pacific Coast division that are in progress of construction this year has been suggested, to be prepared by P. M. Downing of the Pacific Gas & Electric Company, H. A. Barre of the Southern California Edison Company, Carl Heinze of the city of Los Angeles, and J. A. Koontz of the Great Western Power Company, each to handle the work of his respective company. An introductory paper prepared by the group with the cooperation of H. G. Butler,

DO YOU REMEMBER

—that the 10,000-volt line of the San Antonio Light and Power Company of Pomona which held the record for high voltage transmission from 1891-1893, was at first declared to be impossible by the Westinghouse Company, who, however, later installed the equipment?

California power administrator, will cover the power necessities and resources of California, both steam and hydraulic, giving approximate costs and quantities involved.

Factors affecting the fixing of rates on a power factor basis are to be considered in a paper in the hands of a committee of which J. P. Jollyman is chairman.

The subject of relays and the problems which have been introduced by large interconnected systems combining steam and hydroelectric stations has been referred for consideration to a group of five engineers, of which E. E. Stauffacher of the Southern California Edison Company is chairman.

A progress report on the development of 220,000-volt transmission is to be made by a committee of nine under J. A. Koontz of the Great Western Power Company.

The preparation of a paper having the nature of a symposium of operating difficulties has been suggested to be carried out by a committee made up of the load dispatchers of the various companies.

A paper by Carl Heinze of the Bureau of Power and Light of Los Angeles will cover the subject of 33,000-volt triplex underground distribution.

The subject of live wire maintenance, as well as the problems connected with electric furnaces, have been referred to the respective committees in charge of these fields and a committee of two has been appointed to investigate and report on the present status of a proposed bill for the licensing of engineers.

In addition to its other work, the engineering committee is keeping closely in touch with developments in the line and safety codes of California through its sub-committees which are active in these fields. The carrying out of insulator testing work is waiting upon the delivery of material which has already been requisitioned, as reported by the sub-committee in charge of this work.

According to the arrangement under the new constitution, all division committees have representatives upon the national committees and an attempt is being made to have an adequate representation at the national meetings, as well as to keep the local committees in touch with the problems being studied through the national groups. Questions of financing and of the selection of delegates were referred to the appropriate committees.

The work of the Publicity Committee, of which Robert Sibley, editor of the Journal of Electricity, is the chairman, has been held back due to the lack of funds which are necessary for the proper functioning of this committee. However, the members of this committee have not been idle but have joined in with the work of the publicity section of the Public Relations Committee in the preparation of material for use by that committee. After the first of the year when funds are available it is the intention of the committee to carry on the work which was started by the last Publicity Committee and make this service of greater benefit to all the members of the Pacific Coast Section.

Robert Sibley
Chairman Publicity Committee

The commercial committee of which R. E. Fisher, manager of the commercial department of the Pacific Gas & Electric Company, is chairman has planned a comprehensive series of papers as its work for the coming year. For convenience in organizing, the committee has been divided into two parts, A. E. Wollaber being made chairman of the southern section. These have met separately, a joint meeting being planned later to confirm the action taken by the two groups.

R. E. Fisher
Chairman Commercial Committee

Among the subjects selected for study was the electric range. It was felt that due to the increased price of fuel oil and of gas, the present is an especially opportune time for the detailed study of this field and a paper is contemplated covering the following details:

THE ELECTRIC RANGE AND WATER HEATING

(a) Its value to the central station
(b) Its value to the contractor-dealer
(c) Its value to the jobber
(d) Its value to the manufacturer
(e) The sale of replacement parts.

"The Convenience Outlet — Its Progress and Future" is to be considered in a report by Garnett Young, which is to be in the nature of a progress-report following the paper read at the last convention. Papers have further been suggested on the following subjects:

(a) Illumination
(b) Industrial Heating
(c) Meeting the Demand for Retail Sales People.

The subject of the simplification of rate schedules is to be taken up by the committee with the object of clearing up the confusion consequent upon the many and varied forms of schedules now in operation. The committee is keeping closely in touch with the work of the California Electrical Cooperative Campaign and with developments along commercial lines such as the course of instruction being offered by the University of California in "How to Sell Electrical Goods."

One of the most significant actions taken by the committee is its expressed intention to carry on the work begun by the commercial committee of the preceding year. It is felt that the recommendations made through the committee in the various papers and reports presented should be definitely followed up—and that the responsibility for action in this respect rests largely with its successor in the work. In consequence, a study is now being made of the reports of last year, with a view to supplementing the work there begun.

The accounting committee, with P. R. Ferguson of the Southern Sierras Power Company as its chairman is engaged in carrying out a program of work which was effectively started by the accounting committee of last year. Active work was carried on after the Pasadena convention by the former committee in the preparation of a uniform classification of accounts for electric corporations which has been submitted to the accounting committee of the National Association for their consideration. The year's committee is continuing their active interest in this field in cooperation with the national committee in the hope that definite action may be taken toward securing the promulgation of a uniform classification by all regulatory bodies, state as well as federal. The question of a uniform monthly earning and expense statement will also be taken up by the committee as part of this year's work, as well as a uniform method of accounting for property replacements, more especially as to the degree of refinement to which charges to property for minor replacements shall be carried.

P. R. Ferguson
Chairman Accounting Committee

The membership committee of which R. A. Balzari, San Francisco manager of the industrial division, Westinghouse Electric & Manufacturing Co., is chairman, has been subdivided into working organizations operating in districts throughout California, Arizona and Nevada, with one or more members of the committee in charge of each district. In order to fit in with the requirements of the new constitution of the national body, memberships will be dated as of January 1, 1921, so that the new member may have the benefit of the full year. Details of inducements which may be offered new members and of methods of conducting the membership campaign within the local territories were discussed at length at the initial meeting of the committee and an active program for the coming year was outlined. In order to keep Western members in touch with divisional activities, it has been determined to issue three numbers of the "Electrifier," which has been distributed at regular intervals during previous years, these to be sent to members, one about the first of the year, the second in March and the third immediately preceding the spring convention. It is expected that the membership roll will be materially increased before next May.

R. A. Balzari
Chairman Membership Committee

THE ELECTRIC FURNACE AS A CENTRAL STATION LOAD

BY ROBERT M. KEENEY

(The following is an extract from a paper presented at the 1920 N. E. L. A. Convention by Robert M. Keeney, director of the department of metallurgical research, Colorado School of Mines.—The Editor.)

In direct contrast with European practice, central stations have practically all the electric furnace load that exists in the United States, there being only a few isolated plants which generate their own power. Ten years ago so little was known of the characteristics of an electric furnace load that few companies cared to have an electric furnace on their lines. Today, with an electric steel furnace in practically every manufacturing city in the country, the load is considered desirable and is much sought.

The most marked increase in the use of central station power in electric furnaces during the past ten years has been in the electric furnace manufacture of steel. From the viewpoint of the average central station, the most important phase of the present development is in the electric furnace production of steel castings. In 1918 there were manufactured 108,296 tons of electric steel castings representing 21.1 per cent of the total production of electric steel.

As a central station load the electric steel furnace is very desirable, although its load factor is low compared with that obtained in some other electric furnace processes. The enormous momentary peaks which are shown on the load curves of some electric steel furnaces are largely due to the method of operation, and the fact that the operator does not know how to handle the furnace properly.

The central station can better the load factor of the electric foundry furnace by making it an object for the customer to operate his furnace 24 hours per day, through the decreased cost per kw-hr. he obtains. Of course this depends on the peaks in the power company's industrial and lighting load, but there is at present a tendency to install small furnaces for 24-hour operation rather than large furnaces for 10-hour operation, and it is to the advantage of both parties that this tendency be encouraged.

It would seem that electric furnaces, particularly smelting furnaces, are operated at their highest efficiency under contracts which provide for a flat charge per kilowatt month, based on the maximum demand, rather than a charge which includes a maximum demand charge and a kw-hr. charge.

In melting steel and non-ferrous metals in electrolytic refining of metals a power cost of one cent per kw-hr. is reasonable. Notwithstanding the slightly greater cost, the demand for the best steel possible for industrial purposes will eventually increase the consumption of electrically produced ferro-alloys.

DO YOU REMEMBER

—twenty-five years ago when the trolley car was displacing the cable line and the public was worried for fear the service would not be so reliable?

Arc Welding Practice

BY J. H. ANDERTON

(Greater flexibility and better control in arc welding are obtained by the use of metal instead of the carbon electrode. The technique of the art, and the machines used, are here discussed by the chief electrical engineer for Stone & Webster, Inc., in the concluding half of his article. The author was a member of the electric welding committee of the Emergency Fleet Corporation.—The Editor.)

Arc welding includes all the systems of autogenous welding in which fusion of the metal is caused by an arc maintained between the surface of the work and an electrode held by the operator. As previously mentioned, earlier work was accomplished by a carbon electrode and using filling metal, which was fused and fed into the joint by the arc. The principal objections to this system are the high temperatures maintained in the work which is liable to cause excessive stresses in the material due to expansion and contraction, oxidation of the exposed metal and the tendency of particles of carbon to get into the weld. This system is used very successfully by Cramp & Sons of Philadelphia for welding knees, angles, rings, deck frames and bulkhead stiffeners for ship structures, replacing very expensive and difficult smithwork. At Hog Island this same class of work was done by arc welding, using the metal electrode, and approximately thirty thousand pieces were welded in this manner, varying in size from 2 x 3 to 6 x 6 angle. For carbon arc welding, both alternating and direct current may be used. A majority, however, use direct current.

With the metal electrode system, no filling rod is necessary. The metal electrode melts away in the arc and deposits the desired amount of iron or steel in the joint. This system is much more flexible and under better control by the operator than is the carbon arc. The welding can be done by one hand. The temperature conditions are much more satisfactory and the system is therefore rapidly coming into successful use. One of the problems which has

TEST NO. 1

TENSILE TESTS

Twelve strips of ships plate 2″ wide, 24″ long. Eight strips with butt welds in the middle and four strips unwelded.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Reduction of Area at Fracture Per Cent	Final Extension in 8″ Per Cent	Ratio of Weld to Solid Per Cent
			Total Lbs.	Sq. In. Lbs.			
5939	2″ x ¾″ unwelded	1.48	86,400	58,400	49	31.5	...
5940	2″ x ¾″ welded	1.50	87,500	58,300	45	27.0	100
5941	2″ x ¾″ welded	1.50	88,100	58,700	21	19.2	100
5942	2″ x ⅔″ unwelded	1.02	67,500	66,200	49	27.2	...
5943	2″ x ⅔″ welded	1.01	64,200	63,600	47	18.5	100
5944	2″ x ⅔″ welded	1.03	62,800	61,000	22	14.0	92
5945	2″ x ¼″ unwelded	.44	29,400	66,800	29	19.2	...
5946	2″ x ¼″ welded	.44	27,500	62,500	23	6.9	100
5947	2″ x ¼″ welded	.44	27,800	63,200	25	10.5	100
6018	2″ x 1″ unwelded	1.98	111,400	56,300	53	33.1	...
6017	2″ x 1″ welded	1.94	113,800	58,700	49	26.5	100
6016	2″ x 1″ welded	1.96	113,000	57,600	52	26.6	100

Of the above eight welded strips seven broke outside the weld and only one, No. 5944, broke in the weld, at 61,000 lbs. per square inch. The welds were machined on the surface to the dimensions of the test plate.

TEST NO. 2

TENSILE TESTS

Two ships' steel plates, ½″ thick, 5′x3′, with butt welds across the center parallel to short sides. Shaped. Four unwelded test pieces cut from solid plate for comparison.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Reduction of Area at Fracture Per Cent	Final Extension		Ratio of Weld to Solid Per Cent
			Total Lbs.	Sq. In. Lbs.		In 4″ Per Cent	In 20″ Per Cent	
5120	20″ x 49″ welded	9.80	598,900	61,100	24.7	19.0	11.3	97
5121	20″ x 49″ welded	9.80	596,600	60,900	24.4	9.5*	10.9	100
5120	2″ x 48″ unwelded	.96	60,600	63,100	....	23.5	....	...
5120a	2″ x 48″ unwelded	.98	67,700	69,100	....	22.0	....	...
5121	2″ x 51″ unwelded	1.02	61,200	60,000	....	24.0	....	...
5121a	2″ x 51″ unwelded	.96	58,900	61,400	....	26.0	....	...

Both the above welded plates broke partly through the weld and partly through the solid plate.
Welds were not machined but in no case did the welded metal exceed the thickness of the plate by more than $\frac{1}{16}$″.
* In 8″

TEST NO. 3

MODULUS OF ELASTICITY TESTS

Two strips 12″ long, 1″x½″ section, built up entirely of deposited welding metal.

Test No.	Description and Size	Original Area Sq. In.	Ultimate Strength		Yield Point per Sq. In. Lbs.	Ratio Yield to Ult. Per Cent	Reduction of Area of Fracture Per Cent	Final Extension in 8″ Per Cent
			Total Lbs.	Sq. In. Lbs.				
5035	1″ x ½″ shaped	.47	31,100	66,300	42,600	64	17	11.5
	Modulus of Elasticity 28,900,000 lbs. per Square Inch							
5036	1″ x ½″ shaped	.50	31,500	62,900	39,200	62	26	14.6
	Modulus of Elasticity 25,000,000 lbs. per Square Inch							

For comparison it should be noted that the modulus of elasticity of mild steel is 30,240,000 lbs. and of wrought iron 28,000,000 lbs. per square inch.

TEST NO. 4

IMPACT TESTS

Two ships' steel plates, one ¼" thickness and one ¼" thickness, each 5'x2' 6", with butt weld mid length parallel to short sides. Blows were applied along the weld across the full width of the plate. Both blows on same side of plate.

Test No.	Description and Size	Span	Falling Weight Lbs.	Height of Fall Feet	Result
2762	¼" thick, 5"x2' 6"	1st blow, 4' 6"	200	9	Uncracked
		2d blow, 4' 0"	200	9	Uncracked
2763	½" thick, 5'x2' 6"	1st blow, 4' 6"	400	12	Uncracked
		2d blow, 4' 6"	400	12	Uncracked

TEST NO. 5

ALTERNATING STRESS TESTS

Thirteen specimens turned ⅝" diameter with butt weld at center. Rotated at 1000 revolutions per minute. Subjected to constant alternating bending movement in region of weld.

Test No.	Description	Calculated Stress at Periphery Lbs. per Sq. In.	Number of Rotations Before Fracture	Results
2680	Steel plate 36"x15 5/8"x¾" weld, full width 9" from end; cut and turned up into 13 rods	14,330	4,355,000	Fractured
2687		14,330	5,000,000	Unbroken
2689		16,570	5,000,000	Unbroken
2681		16,800	2,000,000	Broke at junction
2690		18,820	5,000,000	Unbroken
2682		19,040	1,705,000	Fractured
2688		20,830	1,510,000	Fractured
2683		21,050	390,000	Broke at junction
2684		22,620	2,230,000	Fractured
2691		25,090	246,000	Broke at junction
2686		26,880	390,000	Fractured
2692		27,550	352,000	Fractured
2685		28,000	150,000	Fractured

NOTE.—It has been determined that an unwelded turned steel bar will withstand a large number of alternations (5,000,000 and over) when the stress varies from +23,500 lbs. to —23,500 lbs. per square inch.

TEST NO. 6

RESULTS OF CHEMICAL ANALYSIS OF ELECTRODES AND DEPOSITED METAL

	Electrodes (Two Pieces A. W. P.) Per Cent	Steel Plate Per Cent	Deposited Metal Per Cent
Carbon (by combustion)	0.149	0.172	0.106
Silicon	0.051	0.020	0.010
Sulphur	0.062	0.034	0.051
Phosphorus	0.050	0.044	0.038
Manganese	0.409	0.430	0.488

TEST NO. 7

COMPARISON OF ARC WELDED AND RIVETED JOINTS IN SHIPS' PLATES
LAP JOINTS

Specimen	Lap In.	Sectional Area Sq. In.	Breaking Stress	Remarks
Welded joint	1.5	1.5	26.7	Broke clear of weld
Welded joint	2.0	2.5	25.9	Broke clear of weld
Treble riveted	7.5	9.6	17.2	Broke through rivets
Treble riveted	9.0	9.1	18.9	Broke through rivets

TEST NO. 8

BUTT STRAP JOINTS

Specimen	Size of Strap In.	Sectional Area Sq. In.	Breaking Stress Tons per Sq. In	Remarks
Welded butt	3.25x.25	2.0	29.8	Broke clear of weld
Welded butt	3.25x.25	2.0	20.0	Broke clear of weld
Treble riveted	12 x.625	6.0	18.3	Broke through rivets
Double riveted	12 x.625	6.0	16.1	Broke through rivets

demanded the very closest attention in this type of welding is the composition of the electrode used. The extreme variation in results as to strength accomplished by different operators under identical conditions with the same electrode pointed definitely to the operator. The reducing effect of the arc converted the steel electrode into iron when deposited. The rapid cooling caused severe crystallization, and the exposure of the molten metal was accompanied by rapid oxidation, so that considerable criticism was directed against the method by metallurgists and engineers. Careful training has now made available an increased number of good welders, and research work has resulted in various forms of covered electrodes which prevent oxidation of the molten metal; and, as will be shown in some of the tables of test results attached, it has practically eliminated the objectionable results from the reducing effect by providing electrodes of suitable composition.

With reference to covered electrodes, it has been noted that the covering should have certain specific characteristics, about as follows:

1. The concentric covering around the electrode must have sufficient mechanical strength to withstand shipment and the handling to be expected around a shipyard or in the shop.

2. Covering must melt and flow at the same temperature and rate as the metal core and when molten, the flux must have such viscosity that it maintains its position around the metal during the transmission of the latter across the arc and when deposited in the weld. In this manner, the slag or covering protects the molten metal from contact with the air and thus reduces oxidation.

3. The specific gravity of the coating must be such that it rises to the surface in the molten mass, otherwise it will cause slag pockets in the weld.

4. The coating must be free from elements detrimental to the steel which might be absorbed in it, such as sulphur, phosphorus or silicon in excess quantities. It should preferably contain such elements as carbon and manganese in quantities to replace such elements lost by the reducing effect.

It is quite probable that more arc welding is being done in this country today by uncovered than by covered electrodes. Very many different compositions are in use and some bare metal electrodes give quite creditable results. There is a general trend, however, towards the covered type, particularly in Great Britain. In this country the covered electrode has been found very desirable where alternating current is used. Alternating current requires greater skill on the part of the operator to maintain the arc, and the covered electrode has some tendency to stabilize and quiet the alternating current arc. From the above it will be evident that the composition of the electrodes is of extreme importance, also the composition of the slag for covered electrodes. It is also evident that different compositions should be used for different classes of work, and it is quite possible at the present time to obtain electrodes to give specific results when used on cast iron, cast steel, rolled steel and even non-ferrous materials.

It not infrequently happens that where arc welding of a general character is practiced, as in a shipyard, only one type of electrode will be used for all kinds of material. It has been the observation of the writer that quite frequently the composition or characteristics of this one will be unknown to the users. Under such circumstances it is to be expected that results will be haphazard and subject to much criticism. It should, therefore, be the object of

DO YOU REMEMBER

—the record-breaking 40-000-volt transmission experiments of the Telluride Copper Company twenty-three years ago? It was conclusively proven at the time that 50,000 volts was probably the upper limit of transmission voltage.

everyone interested in electric arc welding to advance the idea of using such equipment and such operators as will produce proper results.

Arc Welding Machines

Five years ago the machines on the market designed especially for arc welding were limited to a comparatively small number. At the present time practically every electrical machine manufacturer of any importance is prepared to furnish machines of especial design for this purpose either of the fixed or portable type, for the simultaneous use of one or more men, and many concerns will furnish apparatus for either direct or alternating current. The design principle of a majority of the direct current machines is the same; that is, constant energy at the arc. The usual open circuit voltage of the d.c. machine is approximately 60 volts with a welding voltage from 12 to 20. The open circuit voltage of the alternating current machine is approximately 110 and the welding voltage across the arc from 20 to 30 volts. Both types of machines have certain advantages and disadvantages. Where a large amount of welding is to be done in a shop of such character that the work can be brought to the machine, direct current apparatus is usually preferable, one machine being provided with several welding circuits; for portable work in the shop, where it is not possible to bring the work to the machine, either type of machine, depending somewhat upon the electrical distribution system in the shops themselves. For work aboard ship, either type may be used, depending also upon the distribution system on the ways. In general, direct current apparatus is more costly than alternating current, is heavier and therefore less portable. It has an advantage in that much less skilled operators can be used as welders. One of the principal objections to alternating current equipment is the extremely low power factor of this type of machine. It also requires greater skill on the part of the operator. Its cost, however, is much less than the direct current machine.

Results Obtained with Arc Welding

As an indication of what can be accomplished today by arc welding, a series of tables are reproduced herewith, giving comparisons between riveted and welded joints in ship plating and the physical characteristics of welded specimens in comparison with unwelded ones. Tests 1 to 6 show results of tests conducted by Kirkaldy & Sons of London for Lloyd's Register of Shipping. These tests were conducted by a welding company on lap and butt strap joints. It will be noted that the relative cost is given between welding and riveting.

TEST NO. 9

COMPARATIVE COST OF JOINING SHIP PLATES BY RIVETING AND WELDING

Thickness of Plate In.	Description of Joint	Rivets	Cost per Foot
7/16 7/16	Single riveted lap Light welded lap	3/4" dia.	100 % 69.3%
7/16 7/16	Double riveted lap Heavy welded lap	3/4" dia.	100 % 49 %
1/2 1/2	Single riveted lap Light welded lap	7/8" dia.	100 % 72.2%
1/2 1/2	Double riveted lap Heavy welded lap	7/8" dia.	100 % 50.8%
1/2 1/2	Double butt strap Heavy butt weld	7/8" dia.	100 % 46.7%

Problem Course in Electricity

BY H. H. BLISS

(What difference would it make to the brightness and durability of your lamps if all the wiring in your home were changed? The following article, the eleventh of a series, takes up the relations between wire sizes and voltage, and allied problems. The author is on the staff of Riverside Junior College, at Riverside, California.—The Editor.)

PROBLEMS IN WIRING

Cost of Wire.—Wires used for electric distribution are sold by weight, and as the price per pound does not vary greatly in the range of sizes generally used, we may figure the cost as roughly proportional to the weight.

The weight in turn depends upon the cross section area of the wire, and of course the area is inversely proportional to the resistance. Hence, in selecting the size of wire to fit any given conditions, one has to balance the conflicting advantages of low resistance and low cost of material.

It is, of course, desirable to have as low resistance as possible on account of both voltage drop and power loss. On a lamp circuit, for instance, the voltage at the lamps when all are burning should not fall below 97 per cent of the voltage there when none are lighted, for otherwise the lamps will either give unsatisfactory light or burn out early. The cost of the energy lost in heating the conductors is an expense which must be considered in comparison with the cost of the wire. It has been shown that, other conditions being constant, the greatest economy results from selecting conductors of such size that the interest on the cost of the wire is equal to the cost of the energy lost in one year.

To calculate the weight of any length of bare wire of given size, refer to the wire table given with the previous set of problems. Divide the lbs. per 1000 ft. by 1000 and then multiply by the length. For problems involving cost, assume a price of 30 cents per lb. for bare copper. Insulated wire weighs more and costs more than bare wire; tables of weights and prices are furnished by manufacturers and distributors.

At 30 cents per lb., how long a piece of No. 11 bare copper could be bought for $2.70? From the table, 1000 ft. weigh 24.93 lbs.; hence a piece 1000/24.93 or 40 ft. long weighs 1 lb. Then $270/30 = 9$ lbs.; $9 \times 40 = 360$ ft.

Effect of Changing Voltage.—It is interesting to compare the cost of the wire necessary for transmitting a certain amount of energy for a given distance (a) at low voltage and (b) at high voltage.

For a single example, assume a lamp load of 3 kw., the power to be delivered 500 ft. away with a drop not over 2 per cent of the generator voltage. Compare the weights of wire necessary if the pressure at the generator be taken in turn at 110 and 220 volts.

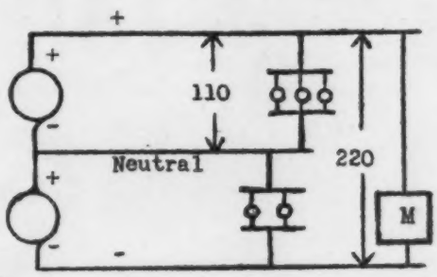


Fig. A.—Three-wire distribution for 110-220 volts. It is possible with modern apparatus to use this method with a single generator or transformer.

For the lower voltage, the drop is limited to $.02 \times 110 = 2.2$ volts, leaving 107.8 at the lamps. The current $= 3000/107.8 = 28$ amperes; the resistance of 1000 ft. of wire must not exceed $2.2/28 = .0785$ ohms. From the table we select No. 00 wire, whose resistance is .0778.

With 220 volts the drop is 4.4 volts; current $= 3000/215.6 = 14$ amperes, half as much as before. Resistance $= 4.4/14 = .314$ ohm. Select No. 5 wire, whose resistance is .3128.

The weights of the wires are: No. 00, 402.8 lbs.; No. 5, 100.2 lbs. Hence with 220 volts the cost for wire is only **one-fourth** as great as with 110 volts. It is to be noted that the power loss is exactly the same in the two cases: $28 \times 28 \times .0778 = 61$ watts; $14 \times 14 \times .313 = 61$ watts. In general, for a two-wire system with a given load, a given loss and a given percentage voltage drop, **doubling the voltage reduces the cost of wire to ¼.** It is now apparent why, in transmitting current over great distances from the western mountain hydroelectric plants to the big industrial centers of the Pacific Coast, the voltages are set higher year after year; to prevent prohibitive losses, the current in the lines must be brought as low as possible and hence voltages much greater than 100,000 are becoming common.

Three-Wire System.—In spite of the higher cost of the wire for the 110-volt distribution in the example above, there are good reasons for preferring the lower voltage. One is the fact that lamps and appliances can be made more rugged and more efficient for 110 volts than for 220. Another reason is the fact that a person coming into contact with live wires has far less chance of serious injury with the lower voltage. If one side of a 220-volt line is "grounded" (that is, connected to the earth, either accidentally or intentionally), one who touches the other wire is likely to take through the body a really dangerous current.

To get the advantages of the 110-volt system and at the same time hold wiring costs down to approximately the level corresponding to the 220-volt distribution, the "three-wire system" was invented. In Fig. A is shown an example of an early three-wire distribution; two direct current generators are connected in series, with three leads going to the load. Lamps are connected between the central wire (known as the "neutral") and either outer wire, and motors may be connected in the same way or between the two outer wires. It is customary to ground the neutral, and then a person coming into contact with one outer wire gets only a 110-volt shock. It is very rare that one touches both outer conductors at once.

To calculate the cost of wire in a three-wire system to carry the 3-kw. load of the example above, consider that half the lamps are on each side of the neutral. The outer wires are then figured exactly as in the case of the 220-volt distribution, and the loss and voltage drop will be exactly as in that case. If the neutral is made the same size as the other wires, as is often done, the total weight of wire is 1½ times as great as for the 220-volt system, and ⅜ as great as for the 110-volt system.

Unbalanced Load.—If half the lamps on one side of the neutral are extinguished while the rest burn, there will be a drop of 2.2 volts in the neutral, and the lamps used will get 4 per cent less than normal voltage, which is too low to be satisfactory. Hence it is customary to balance the load in such a way that approximately as much current is drawn through one outer wire as through the other.

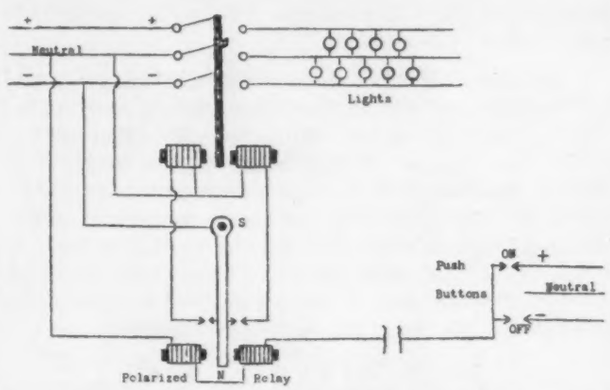


Fig. B.—Three-wire lighting system controlled magnetically from a distance of a mile or more. The armature of the polarized relay is a permanent magnet.

If the neutral breaks or is disconnected while the load is perfectly balanced, it will make no difference, for under such circumstances it carries no current. But if the load is unbalanced such an accident may cause serious trouble. Suppose that a load of resistance equal to 3 ohms is on one side of a 110-220 volt system and a 10-ohm load is on the other. The breaking of the neutral means that 220 volts will be applied to $3 + 10 = 13$ ohms; the current will be $220/13 = 17$ amperes (if the resist-

DO YOU REMEMBER

—in 1887 when the Journal of Electricity was started, at a time when the electrical industry itself had been in existence not quite ten years and the first electrical paper in New York was only two years old?

ances remain the same), and the voltage applied to the 10-ohm load will be 17 × 10 = 170, sufficient to burn out the lamps very quickly.

In this example it was assumed that the resistance of the load did not vary when the breaking of the neutral changed the current. With a lamp load this assumption is not in accord with the facts, for lamp filaments do alter their resistance whenever the temperature changes. Metallic wires, such as the filaments in Mazda lamps, offer more resistance when they get hotter, while carbon filaments decrease their resistance as the temperature rises. Hence if the lamps in the example above were of tungsten, the 10-ohm load, becoming hotter than before, would increase its resistance, while the 3-ohm load would decrease its resistance. There would accordingly result an even more pronounced disproportion of voltage and the quicker destruction of the lamps in the 10-ohm load.

As carbon lamps have a greater resistance cold than hot, when current is started in them it increases comparatively slowly, in contrast with the instant brightness of the tungsten lamp. Had the lamps in the example been of the old carbon type, the difference between the two voltages would have been much less than was calculated.

Remote Control.—The arrangement diagrammed in Fig. B is used on the San Francisco waterfront for lighting piers a mile or more from the office of the harbor electrician. Examination of the sketch will disclose the fact that the control current flows either forward or backward in the single control wire, returning through the earth or the neutral wire. It causes the armature of the relay to move to the right or left, thus sending a strong current to the main magnets which throw the lighting switch.

Answers for First Wire Problems

109. **3600 C. M.; 62,500 C. M.; 4,840,000 C. M.**

110. A one C. M. wire of this length would have 4000 × 10 = 40,000 ohms; 40,000/400 = 100; hence the given wire has 100 C. M. area and a diameter = sq. rt. of 100 = **10 mils.**

111. Area = 300 × 300 = 90,000 C. M. Resistance = 7300 × 10.65/90,000 = **.864 ohm.**

112. 62.5 × 875 = **54,700 sq. mils = 69,700 C. M.** Resistance of 1000 ft. = 1000 × 10/69,700 = **.1435 ohm.**

113. A one C. M. wire 860 ft. long would have 8600 ohms resistance; it would take 8600/.3 = 28,670 such wires to give a resistance of .3 ohm. Hence section area = **28,670 C. M. = 22,500 sq. mils.** Thickness = sq. rt. of 22,500 = **150 mils.**

114. A one C. M. wire would have 5/12 of 10 or 4.17 ohms; the given wire is equivalent to 4.17/.0515 = 81 such wires. Cross section = 81 C. M.; diameter = **9 mils.**

115. **4.185 ohms; 5.07 ohms.**

116. **220 feet.**

117. **No. 28.**

118. For 75% efficiency, the kw. in = the hp. out. 10,000 watts at 100 volts means 100 amperes; 4 volts drop with 100 amperes gives ohms = 4/100 = .04 ohm in 500 ft. of wire, or .08 ohm per 1000. Hence select **wire No. 00.**

119. 250,000/37 = 6,760 C. M.; diameter = sq. rt. of 6,760 = **82.2 mils.** Resistance = 267,750/6,760 = **39.6 ohms.**

120. Loop resistance = 2 × 26.775 × 1.999 = 107 ohms. Drop = 32.1 volts. Remaining voltage = **7.9.**

121. Length of average turn = 3.14 × 4.2 = 13.2 in. = 1.1 ft. Total length = 360 × 1.1 = 396 ft. Resistance = .396 × 6.374 × 1.064 = 2.69 ohms. Current = 22/2.69 = 8.17 amperes. Ampere turns = 8.17 × 360 = **2,940;** watts = 22 × 8.17 = **180.**

Second Set of Wire Problems

Note: A wire table arranged conveniently for working these problems is to be found in the previous issue of the Journal of Electricity, page 530.

122. In a certain large building one pair of wires must carry 85 amperes a distance of 175 feet from the switchboard. Find the safe size of rubber covered copper wire and the weight of copper in it. What is the drop in this line?

123. A small spool contains 70 feet of bare copper wire, No. 20, B & S Gage. The spool is sold for 30 cents; calculate the cost of copper per pound.

124. In the diagram of remote control (Fig. B), does the control current flow **into** or **out of** the paper at the upper side of the right hand relay magnet when the "ON" button is pressed? Which way does the current flow in the other relay magnet?

125. How long must a No. 2 copper wire be in order that its weight in pounds may equal its cross section area in circular mils? Repeat for No. 20 and No. 36 and get an approximate rule for all sizes.

126. At 400 feet from a 115-volt generator there is to be installed a d.c. motor which takes 36 amperes at full load and 3 amperes at no load. Find size of wire to use to limit the voltage drop to 4 volts, and determine voltage at motor at no load.

127. A load of 42 kw. is to be transmitted a distance of 6,000 feet on two wires. The input to the line is not to exceed 45 kw. Find weight of copper required if the voltage at the load = 600. Repeat for a voltage of 2400.

128. A three-wire system has No. 10 wires 125 ft. long. Find voltage at each lamp if generators give 116 volts each and there are 40 half-ampere lamps on each side of the neutral. Find voltage at load if all the lamps on one side of the neutral are turned off.

129. On the basis of the data for wire No. 5, calculate the weight of one cubic foot of copper.

130. Ten 880-watt electric stoves are connected to the same 110-volt circuit 70 feet from the switch cabinet. What size copper wire must be used to limit the voltage drop to 3 volts? Is this wire large enough to be safe?

131. Find the cost of copper at 30 cents per lb. for a three-wire system delivering 5 kw. at 120-240 volts 1300 ft. from the generator with voltage drop not to exceed 3% of the voltage at the load. Make the three wires of the same size.

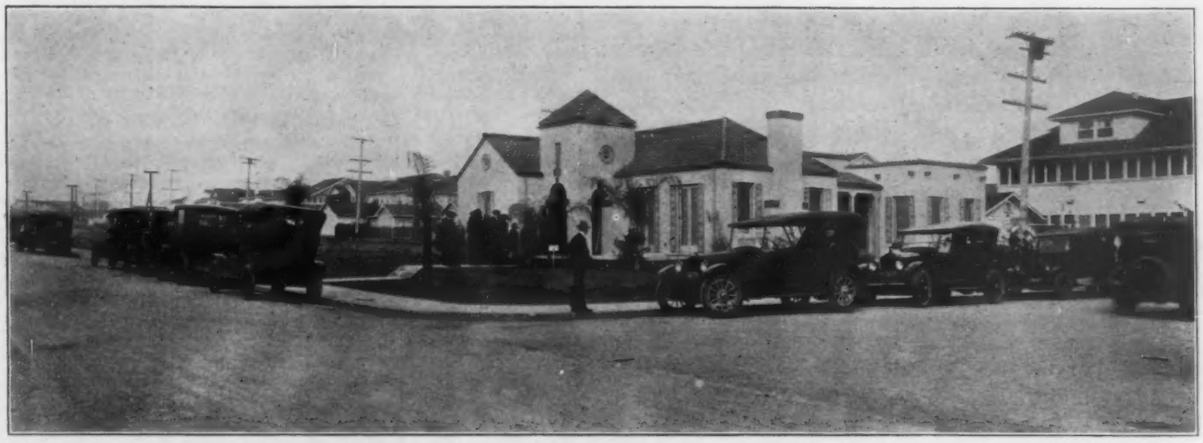
132. What is the voltage distribution in the system of Problem 131 if the neutral breaks when there is a load of resistance equal to 6 ohms on one side of it and 9 ohms on the other? Assume 247 volts at the generators.

133. If the ampere-turns on a certain magnet = 12,000, find the applied voltage. The number of turns is 2400, and the average length of one turn is 8 inches. The wire is 40 mils in diameter and has 10.7 ohms per C. M. foot.

134. A motor and a generator 319 feet apart are connected by two No. 8 copper wires. If the generator delivers to the line 18.9 kw-hr. in 10 hours, and the motor (of 75% efficiency) gives out 1.80 hp. continuously, what is the current in the line and the voltage at the motor?

TELEPHONING PHOTOGRAPHS

A photograph that was telephoned from Antwerp to the Matin office in Paris recently, depicted Swedish women athletes marching in the Olympic Games Stadium. The photograph was telephoned the 200 miles in eight minutes. Considerable attention is being given in London just now to the use of the telephone in connection with the transmission of photographs. One London newspaper has interested itself in this new development of pictorial telephony and has displayed whole pages of really first-class photographs that were submitted many miles away by telephone.



This Electrical Home of Los Angeles is one of the several which have been opened to the public under the auspices of the electrical industry in California. They have done more than any other one factor to impress the advantages of the convenience outlet upon the public mind.

A Year's Work for Cooperation

BY LEE H. NEWBERT

(Among achievements of the electrical industry in the West, the California Electrical Co-operative Campaign holds a distinctive place. The chairman of the Advisory Committee here reviews the Campaign's work during the past year, and outlines the work planned for 1921. —The Editor.)

A glance back over the work done in 1920 by the California Electrical Cooperative Campaign shows many accomplishments within the electrical industry and for "Better Service to the Public."

Spreading the Convenience Outlet Idea

Outstanding among these accomplishments of 1920 is the development of the convenience outlet idea which has been received with enthusiasm by the electrical industry, and not less enthusiastically by the public and those who serve them in home planning and building—namely, our friends the architects, subdividors and builders. Many of these throughout the state have been visited, and to them has been explained the service which they can render to their clients and customers by providing proper wiring and adequate convenience outlets in the homes, apartment houses and business buildings which they desire, build or sell. The majority of them grasped at once the fact that the interests of themselves, their clients and the electrical industry are at one in this matter, and the few who doubted must certainly have been convinced by the interest in proper wiring and convenience outlets shown by the 150,000 visitors who have crowded the five Modern Electrical Home exhibits opened to the public in California during the past few months. The unquestionable value of the service which the Cooperative Campaign is able to render to the public and to the electrical and other industries concerned with home building by cultivating the idea of proper wiring and adequate convenience outlets, is the real reason for this work of the Cooperative Campaign having met with such encouraging success. "Better Service to the Public" is our motto and better service to the public must be the outstanding result of our efforts if the results are to be worthy of the effort involved.

The Newspaper's Electrical Page

Not less important than the convenience outlet idea, although from its very nature less easy to evaluate in terms of service to the public, is the advertising campaign which was conducted during the past year and which closed August 1st after Electrical Pages had been established in newspapers of all towns in California large enough to support them creditably. While the amount of advertising space and publicity obtained for the electrical industry was large and of material value to the industry, the more important result achieved was the awakening of all branches of our industry to the fact that every desirable kind of publicity should be employed to carry to the public the industry's message of its service and its problems, and above all the idea of the mutual self-interest of the public and the industry in the development of California's hydroelectric energy. Much good also has been accomplished in improving the character of all electrical advertising by continually emphasizing the value of truth and an ethical attitude toward competition. I venture to express the opinion that none of the electrical advertisers who have come closely into contact with the work of the Cooperative Campaign would now consider for a moment the violation of either of these fundamental principles of good business and good advertising, and that as a result the advertising of the electrical industry is fixed on an ethical plane which will amply justify the confidence of the public.

DO YOU REMEMBER

—In 1897 when Lander, Wyoming, then a town of 1500 inhabitants, hauled the materials for its electric plant 150 miles from the nearest railway over mountain trails on mule back?

Cooperating with the Contractor-Dealer

A highly important part of the past year's endeavor was the continuation of the work upon the problems of the individual electrical contractor and dealer, store location and arrangement, window and interior display, store management and salesmanship; all received their just proportion of the field representatives' efforts, and to learn of the advance made along these lines one has only to observe the contractor-dealer establishments of today and contrast them with those of a year or two ago. Another phase of the contractor-dealer's business which has received special attention from the Cooperative Campaign is that of proper accounting. Much good has been accomplished through the installation of the Standard Accounting System of the National Association of Electrical Contractors and Dealers by the representatives of the Campaign. Moreover, the importance of proper accounting methods in the determination of present conditions and future policy in any electrical retail business has been brought home to the minds of all branches of the electrical industry in California, so that the interest now manifest in this most vital subject gives promise of even greater forward strides during the coming year.

Cooperation, that cumulative force which creates great undertakings and in their achievement re-creates itself, has developed in an inspiring degree within the electrical industry of California through the medium of the California Electrical Cooperative Campaign, until the eyes of the electrical industry of the entire country are turned with interest to observe its results and to learn its methods. Those at a distance are often better able to place a proper value upon its work and it is indeed gratifying to learn that the principles and methods of cooperative effort in California are being approved and adopted by the electrical industry in many other sections of the United States, and that the "California Idea" bids fair to become nation-wide.

Plans For the New Year

With such evidences of confidence in the underlying principles and policies of the California Electrical Cooperative Campaign, the Advisory Committee undertakes the work of the coming year with renewed vigor, and has formulated its plans with confidence but with care. Briefly, these plans include the following principal lines of action:

1. Extensive development of the convenience outlet idea, including personal work with architects, builders and subdividors, the establishment of Modern Electrical Home exhibits in all the principal cities and towns of the state, and lectures and bulletins on the industry's part in developing the convenience outlet idea. This work will include the presentation of this idea to the electrical journeymen, because the Advisory Committee believes that the workmen who come daily in contact with the public can aid materially in extending to the public the convenience outlet idea, and will gladly do this when the self-interest of the electrical journeymen in this matter has been pointed out to them.

2. Proper accounting by electrical contractors and dealers will be furthered through lectures on this subject before local groups of contractors and dealers, and by bulletins addressed to the various branches of the industry in California, explaining how they can assist in promoting better accounting. The presentation of this subject by the Cooperative Campaign will tie in with a correspondence course on Accounting for Electrical Contractor-Dealers now in preparation by the University of California and based on the Standard Accounting System. The Advisory Committee believes this will afford the contractor and dealer the fundamental understanding of accounting which is so necessary to the proper conduct of any business which expects to develop.

3. The Advisory Committee recognizes the vital importance to the electrical industry and the public of the rapid development of our hydroelectric resources. It will therefore undertake to present this subject to the industry and to the public through a Speakers' Bureau, providing speakers of recognized authority to present on all proper occasions the message of the service of the electrical industry to the public and the necessity for action by the public in their own interest to make this service available. The work of the Speakers' Bureau will be correlated with the work of the Public Relations Committee of the Pacific Coast Section, National Electric Light Association, and will be supplemented by bulletins and other publicity sent to the industry and to the public.

4. The Cooperative Campaign will devote much time to the subject of Industrial Illumination during 1921. The exhibit of industrial lighting in San Francisco is now open and the work of installing a similar exhibit in Los Angeles is under way. These will be permanent exhibits of the same general description as the exhibit at the Pasadena Convention of the N. E. L. A., and lectures on the principles of proper industrial illumination and the benefits to the industrial or commercial establishment utilizing such service, as well as the beneficial effect upon employes and the consuming public, will be presented on announced dates in connection with the exhibit.

In addition to the permanent industrial lighting exhibits at San Francisco and Los Angeles, the Advisory Committee is providing for a portable exhibit which will be shipped from city to city in California, covering the industrial territory outside the cities of Los Angeles and San Francisco.

The foregoing outline is not intended to create the impression that other activities of the Campaign are to be discontinued. The Advisory Committee will continue its work with all the problems of the contractor-dealer as well as with the various other questions affecting "better service to the public." Armed with the fruitful experiences of the past three years, and reposing its confidence in the continuation of that fine cooperation of the electrical industry which has made possible the successes of 1920, the Advisory Committee believes that 1921 will surpass in achievement any year of the history of the California Electrical Cooperative Campaign.

A neat window display in the store of E. Brettell, president of the contractor-dealers' association, Vancouver, British Columbia

Work of the Electrical Jobbers in 1920

BY C. C. HILLIS

(The effectiveness of the electrical industry depends upon the combined cooperative activity of its various groups, and a realization that their interests are the same. The chairman of the Pacific Division of the Electrical Supply Jobbers' Association outlines in the following article the contribution of the jobbers to the well-being of the whole.—The Editor.)

This is the period of the year for taking inventory. Individuals should take stock of their efforts during the year to see how closely they have followed the Golden Rule and if they have shortcomings, they should turn over the proverbial "new leaf" at the beginning of 1921. Mercantile establishments are taking inventory to determine whether their business is going to show up for the year in red ink or on the right side of the ledger. It is also the proper time for industries to take inventory of their efforts, to determine whether they have been directed along lines that have had an uplifting influence and have made for a definite advancement for the companies and individuals engaged in them.

In taking stock of the work which the electrical supply jobbers of the Pacific Coast have been doing for the advancement and upbuilding of the electrical industry on the Coast, it is found that they have been playing many parts. I believe it is fully recognized that the Pacific Coast Electrical Supply Jobbers have for years been found prominent among those working for the betterment of the electrical industry and striving to bring about the best relations among the different branches of the industry, in order to insure harmony and a better understanding of their mutual problems.

For many years the jobbers have taken a very active interest in the work and problems of the electrical contractor-dealer and it is no doubt due in a considerable measure to their efforts that the electrical contractor-dealer, doing business on the Pacific Coast, is recognized as being far ahead of those similarly engaged in other sections of the country along all lines of business practice, good merchandising and a recognition of the proper ethics of the industry.

California Electrical Cooperative Campaign

It was the electrical jobber who took the first step towards having the central station better understand the work they were doing for the development of all things that made for improvement in the industry, and this culminated in giving the jobbers a place in the Geographic Section of the National Electric Light Association, out of which grew the cooperative work now being carried on by the Advisory Committee and known as the California Electrical Cooperative Campaign, the Advisory Committee being taken from all of the branches of the industry, and on which the jobbers have had a representative who has taken a very prominent and active part in all of its work.

In recognition of the close harmony prevailing on the Coast the Electrical Supply Jobbers' Association, at their national meeting held at Del Monte in May, appointed a committee to go to Pasadena and attend the national meeting of the National Electric Light Association, which was held there the week following the electrical jobbers' meeting in Del Monte.

At the national meeting of the electrical supply jobbers above referred to, the cooperative program of the electrical industry on the Coast was explained in detail to all the visiting members and their guests, and it is hoped by the electrical jobbers generally throughout the nation that the cooperative spirit so well known here on the Coast may be emulated by those engaged in the industry in other sections of the country.

Homes Electrical

During the past few months a great deal of good work and publicity has been given to the electrical idea by the Homes Electrical put on exhibition in San Francisco, Sacramento and Oakland, at which exhibitions thousands of people had an opportunity to see up-to-date and properly equipped electrical homes. In these exhibits the jobbers have given freely the use of their salesmen for demonstration purposes, in some instances have loaned material for display purposes and have helped in the financing of the publicity necessary to bring the general public to pay a visit to these exhibits.

Cooperation of Jobbers

The service given to the customers of jobbers during the past year is one of which the jobbers should feel proud. The most trying conditions, such as unusual manufacturing difficulties, freight embargoes and delays in delivery, due to freight congestion, strikes, etc., have been fairly well solved by the electrical jobbers who boldly endeavored to carry stocks much larger than would be needed under more nearly normal conditions, and with few exceptions the jobbers have given very excellent service. This service was largely improved and made possible by the close harmony that exists among all of the different competing jobbers and through their unselfish cooperation in the way of interchange of stocks when any particular jobber was short. The letting go of merchandise—in many instances goods which had a ready sale—by one jobber to his competitor in order that he might give service to his customer, is surely the acme of the spirit of cooperation, and I believe that the customers of the jobbers

DO YOU REMEMBER

—that on Feb. 11, 1854, San Francisco was first lighted with coal gas, a banquet given at the Oriental Hotel honoring this occasion? The price per 1000 ft. was $15, coal was $36 to $40 per ton, labor $6 to $7 per day and interest 36% per annum.

generally fully appreciate what this has meant to them.

The credit departments of the various jobbers have worked very closely together and have also been helpful to the contractor-dealers, giving them any help and advice in matters pertaining to financial questions where they were of any use. Where they could assist in the installation of proper accounting methods and systems for proper cost data on contracting jobs, they have freely given of their time, and that branch of the industry as a whole has through their effort undoubtedly been improved.

The jobbers have taken a very active interest in the effort being made to further better illumination in stores, offices and factories and were more than willing to donate part of the material used in the installation of a demonstration room, which has recently been installed in one of the offices of the State Accident Commission in the Underwood Building. This demonstration room, as far as possible, duplicates the demonstration shown at the Pasadena Convention of the National Electric Light Association. The demonstration is made with the idea of arriving at proper illuminating conditions under which employes may work with safety to their eyesight and improve their efficiency, and in no way gives publicity to any particular manufacturer's goods. There is no denying that few buildings where people are employed are properly illuminated to get the most efficient results, and when the general public realizes the illuminating conditions under which they have been working for many years, it will no doubt bring about changes in their establishments which will improve their own efficiency, giving wiring jobs for the electrical contractor-dealer, help the manufacturer and jobber and incidentally make a better customer for the central station.

Assisting Central Stations

One of the new movements taken by the electrical jobbers is the one to assist the central stations in the sale of their stock so that their program of extension for the next few years may be more easily accomplished. At an open meeting of the Electrical Jobbers at Del Monte about six months ago this subject was discussed at some length, and at a meeting there in October a number of manufacturers and central station representatives were in attendance and took part in a further discussion of this subject. As a result a committee was appointed to make a thorough investigation and see what the jobbers could do to help. As was pointed out in the discussion, the community develops as the central station develops. If the lighting companies are unable to give adequate service to all their customers, or are not in a position to take on the service of all who may apply for it, it serves to retard development in all lines of industry. Obviously, therefore, people in all walks of life should be interested in seeing the lighting and power companies properly financed so that all communities may be given service, and the entire state an opportunity to develop and grow. This function of the central station in the development and growth of communities is not very well understood, even by a large percentage of the people who are directly connected with the electrical industry, and it is not strange, therefore, that people in other lines of business should not see how vitally affected their own business might be if the central station cannot continue to satisfactorily perform its functions of serving a community with heat, light and power.

It is the thought of the jobbers that the people in the electrical industry should at first be made acquainted with the obligation which those in the industry owe to the proper development of the lighting companies and that the public at large should, as soon as possible, be informed of just what this development means to them from a self-interest standpoint.

This jobbers' committee, working in connection with a further committee appointed by the Electrical Development League of San Francisco, is now studying this problem from all its angles and it is hoped that a successful plan can be worked out by which all engaged in the electrical industry may be induced to purchase stock of the lighting companies, which is now being offered for sale and which returns a very good rate of interest on money invested. The plan contemplates enabling the employes who are not able to buy stock outright to purchase this on a partial payment plan. While the total amount of stock which the employes can purchase will not go very far towards the work of financing the additional extensions, it will serve the purpose of getting each individual in the industry more vitally interested in his industry's problems and will show the bonding companies in the Eastern financial centers that all those engaged in furthering electrical matters on the Coast are working in harmony.

The electrical jobbers at all times have their coats off and are prepared to go to the bat and work for the good of the industry as a whole.

ELECTRICAL POWER PRODUCTION IN SOVIET RUSSIA

The generation and distribution of electric power in Russia is under the control of the Soviet department of electricity. This department manages 10 nationalized power plants, 45 nationalized factories for electrical machinery, telephones and telegraphs, and 19 works not yet nationalized. The aims of the Soviet government are to build new power plants and to supply electric current to farmers, sawmills, mines, and to all larger foodstuff producers.

A statement issued by the government regarding the future of the electrical industry in Russia is full of optimism and goes so far as to say that all the resources of the country will be utilized by electric power, bringing the country to a state of prosperity unparalleled in its history. At present only 8,000,000 kw-hr. are produced in Moscow per month, and still less in Petrograd, owing to the shortage of fuel. In Moscow only three of the existing five power plants were running in January, but the other two have been put to work since.

A Page of Cooperation Figures

FINANCES

1918		1920	
Contractor-dealers	$2,000	Contractor-dealers	$3,600
Jobbers	3,200	Jobbers	6,000
Manufacturers	1,300	Manufacturers	9,000
Power companies	5,900	Power companies	9,000
		Technical press	270
	$12,400		$27,870

The success of the cooperative idea is nowhere better attested than in the increased subscriptions to the California Electrical Cooperative Campaign during the past two years. Note especially how the contributions of the manufacturers have increased since the opening year of the Campaign.

CONTRACTOR-DEALER ASSOCIATION

Increase in membership, November 1, 1919, to April 1, 1920	160
Present membership	315
Increase in dues @ $60, November 1, 1919 to April 1, 1920	$ 9,600
Total revenue from dues	18,900
Appropriated to Campaign	3,600

The increase in membership in the Contractor-Dealer Association during the past year of the Campaign's work, and the corresponding increase in dues, is a practical illustration of the growth in group interest and the resulting financial benefits both to the Association and Campaign.

STORE IMPROVEMENTS

		Per Cent
Number of stores	400	100.
New stores	90	22.5
Better locations	70	17.5
Remodeled	95	23.75
	255	63.75
Accounting systems installed	75	23.00
Minor improvements	400	100

Some of the tangible results achieved by the Campaign during its first year of active work are interestingly shown in the above figures. Minor improvements include such things as additional lighting, new arrangement, and everything short of remodeling the store.

CHRISTMAS ADVERTISING

	1918	1919	Gain
Column inches by dealers	19,488	100,649	81,161
Number of insertions	1,218	6,337	5,119
Publicity			7,520 inches
Efficiency of clipping service:			
Advertising, 75%; publicity, 50%			

The value to the electrical dealer of timely and adequate advertising has been consistently pointed out by the Cooperative Campaign, and the increased publicity activity as shown by the Christmas figures above, testify to the practical results and to the retailer's cooperation and success in putting over the "Electrical Christmas" idea.

SOLICITORS

1918—26 dealers	30
Power companies	60
1919— 82 dealers	176
1920—100 dealers	200
Average monthly salary	$ 150
Aggregate monthly salary	30,000
Total monthly sales (estimated)	300,000
Aggregate yearly salary	360,000
Total yearly sales (estimated)	3,600,000

It is significant that with the increase in the number of solicitors employed by retailers, the power companies have tended to withdraw from the field. The salaries and commissions which it is profitable to pay these solicitors indicate resultant increase in sales.

ELECTRICAL APPLIANCES

Homes in United States	22,000,000
Homes wired for electricity	7,000,000
Average investment in electrical equipment	$ 150
7,000,000 homes @ $150	1,050,000,000
@ $600	4,200,000,000
5,000,000 new homes required, @ $760	3,750,000,000
Possible appliance business	9,000,000,000

AUTOMOBILE SALES IN CALIFORNIA

1912	83,000 cars
1920	491,000 cars
Business done in past eight years	$450,000,000

A comparison of the investment in electrical equipment in the average home with that necessary for adequate electrical convenience shows that the saturation point is still far off. The fact that automobile sales could increase business by $450,000,000 in eight years should point the way for the electrical industry.

CONVENIENCE OUTLETS — WASHINGTON

Homes in Washington	350,000
One convenience outlet to each home @ $2	$ 700,000
20 convenience outlets to each home @ $2	14,000,000
Loss by not encouraging sufficient outlets	13,300,000
New homes needed	70,000
20 convenience outlets to each home at $5	$ 7,000,000
1 convenience outlet to each home @ $5	350,000
Possible additional business	6,650,000

ELECTRICAL APPLIANCES — WASHINGTON

Homes in Washington	350,000
New homes required	70,000
Average investment in old home	$ 150
Investment required to make home electrical	750
Total possible new business	262,500,000

The increase in home building is the contractor-dealer's opportunity, as shown by the above figures on possible new business for Washington. Cooperative work in the industry is being largely directed towards the proper electrification of the home through more convenience outlets.

ELECTRICAL CONVENIENCE OUTLETS—OREGON

OLD HOMES

Homes in Oregon	185,000
Average number of convenience outlets—1 each @ $2	$ 370,000
Convenience outlets required under plan, @ $2	7,400,000
Loss by not encouraging sufficient outlets	7,030,000

NEW HOMES

New homes required	35,000
20 outlets to each, @ $5	$3,500,000
1 outlet to each, @ $5	175,000
Possible additional outlet business under new plan	3,325,000

ELECTRICAL APPLIANCES — OREGON

Homes in Oregon	185,000
New homes required	35,000
Average investment in old home	$ 150
Investment required to make homes electrical	750
Total possible new business	137,000,000

The sale of appliances is definitely related to the number of convenience outlets in the home. The present average is one outlet per home; the proper quota is estimated at 20. A lack of activity in promoting the electrical home idea involves a tremendous loss for the contractor.

DO YOU REMEMBER

—that in February, 1896, Fresno was planning to celebrate the completion of power connections to the city—a project which two years later was in the hands of a receiver?

Art in the Electrical Store

(Electrical merchandise has been sold with hardware and in department stores, and combined with many other kinds of goods. Here is an account of a high-class electrical store which combines it successfully with art goods, and attains thereby a distinctive atmosphere which is among the contractor-dealer's most valuable assets.—The Editor.)

This is not just one more treatise on the artistic arrangement of the electrical store but an account of an electrical store which looks like an art store, and indeed is partly an art store. It reaps its advantage in that it has also captured the atmosphere of the art store, with all its charm and leisureliness, its appeal to the woman buyer, and its ability to tempt the customer to "browse." Not that all electrical dealers must necessarily turn their stores into art stores, but the success of the Spott Electrical Company of Oakland, California, commands interest in, and respect for, its methods.

This charming rest room for ladies was later transformed into a fixture room, the attractions of the rest of the store proving so strong that it was very rarely used.

The manager will tell you firmly that this is not a "contractor-dealer store." It is an electrical retail store; the contracting department is kept a mile or so away in an entirely different part of town.

Plugs and wire and sockets and lamps are not featured in this charming interior, though you can find them all in a not too conspicuous corner. All the different kinds of merchandise are segregated, so that one show case contains nothing but shining percolators, and another nothing but electric irons. In the window displays, also, appliances are kept entirely separate from table lamps, for instance; as the store has a corner location with several windows, this plan is very easily carried out.

The floors of the windows are of polished wood, and long drapes of bright cretonne or dark velvet, according to suitability, set off the display. There are no prices in the window, as if they are large enough to be seen they spoil the appearance, and also make the first impression one of prices instead

Interior of the Spott Electrical Company's store dressed for a gala occasion. Flowers, however, are a regular part of its arrangement.

of quality and service. Inside, however, every article has a small price tag, so that it is not necessary for the salesman to be in constant attendance while the customer makes a leisurely selection, or looks around while waiting for his package to be wrapped. No display cards are used.

Besides electrical appliances, lamps, fixtures, and all the usual small wares of the electrical retail store, the Spott Company carries various art goods for the home such as pottery, vases, fire screens and book ends. These not only lend themselves very readily to effective display, but tacitly assume that art goods and electrical goods are not at opposite poles, and that beauty and utility belong together. The advantages in display are quickly seen where the light from a tall standing lamp falls on a dark polished table covered with old bronze and blue bowls, and farther on an artistic fire screen and a great copper vase full of flowers give a home touch to a room devoted entirely to fixtures.

The Home Atmosphere

Delicate grey paneled walls and white paint set off the soft rich colors of the interior, and rugs and wicker chairs create an atmosphere which is calculated to make the woman shopper feel as much at home as in an establishment devoted to Paris fashions. Moreover all the salesmen are women, who can sell irons and percolators and grills in the idiom of their women customers. Also—so says the manager—they give to the store arrangement the homelike touch which the mere heavy-handed male finds hard to imitate with far greater effort. A special little sitting room was originally prepared for women customers, but was later abandoned as it was found that the women did not use it, preferring to wander about the store.

Character in Display

Jewelers' cases are freely used in the display of the smaller appliances as being the best means of keeping the articles in first-class condition, and providing a neat and attractive system of arrangement. The very large appliances such as washing machines and electric ironers are relegated to the background, not only because they do not harmonize with the general character of the store, but because they are not considered among the store's specialties. A large washing machine business usually means an elaborate time-payment system, and the Spott establishment has found that its merchandising sales have developed more profitably along its own particular lines—fixtures, lamps, the smaller appliances, and art goods.

Business Methods

Accounts are kept separately for the four divisions of Fixtures, Motor, Construction, and Merchandising. Fixture work is a specialty, and there are three or four small rooms adjoining the main part of the store devoted entirely to the display and demonstration of fixtures of all kinds.

Advertising is done through an agency, and by means of signs outside construction work. There is no soliciting of any kind. The system is to give unlimited attention to the individual customer, making perfectly sure that each is more than satisfied, both with his purchase and with his treatment; and results have proved that a friendly customer is one of the best business-getters. Conversely, it is fully realized that a sale which does not give the customer permanent satisfaction is likely to deprive the firm of far more business than the price of the article. A bad sale is not merely not an asset, but a definite loss. For this reason, also, only first-class standard goods are stocked, and no repairs are made on other than standard goods.

The Spott Company's store is an excellent illustration of the dollars-and-cents value of "tone" in a retail establishment. There are a number of ways of creating this tone, and each dealer must work it out for himself, according to the demands of his business, his location, and his customers. But the fact remains that the distinctive atmosphere, the touches which give the store individuality and a character, play a phenomenally large part in the building up of an electrical retail business.

Living Room Lighting
must accomplish two things—a clear diffusion of light throughout the room, in order to give a happy, homelike atmosphere and concentration of light in certain places, for example, about the table and on the piano keyboard.
If you are interested, come and talk with the men at Spott's, who understand the science of illumination.
Spott Electrical Co
Clay at 16th

A sample of newspaper advertising, illustrating the policy of selling illumination rather than fixtures, thus emphasizing beauty and quality rather than price.

DO YOU REMEMBER

—when plans were first made for crossing San Francisco Bay by electric span in the record-breaking 110-mile Blue Lakes transmission line of the Blue Lakes Water Company, headed by Prince Poniatowski?

Pamphlets and Clippings in a Business Library

BY VIRGINIA FAIRFAX

(Files may be as bad as waste baskets if they are not handled with intelligence and skill. In the following paper, the fifth of a series, the librarian for the Carnation Milk Products Company discusses the proper classification and indexing of pamphlets and clippings. The series is copyrighted.—The Editor.)

HOW INFORMATION IS CLASSIFIED AND INDEXED — Part 1

Readers must bear in mind that these articles relate to care of pamphlets and clippings in business libraries. In many public libraries this class of material is considered ephemeral, as advance sheets of information which later will be received in book form, and no records whatever are made. The material is filed alphabetically according to subject, and in the official and public catalogs "See also" references are inserted at the end of the subject entries, that direct the inquirer to the special subject information in the vertical files.

In a business library, however, the bulk of this material will have permanent value, and much of it will represent all the facts that the library will ever have on some subjects. Under these circumstances it is wise to have some record, a record of possession, or of receipt, of the most important contents of the files. A business library is worked **intensively**, it cannot accumulate as a public library does; office space is very valuable, so it "plows deep" and makes available and useful every fact in a small amount of material. In other words, the material is closely analyzed for information that bears on the company's interests and every paragraph of value is made to furnish its quota of facts. It has been said that "a public library wants a little of something on everything, but a business library wants everything on something," and in this latter case an analysis of the contents of the pamphlets must be made.

Simplicity in Filing

In some libraries the material placed in these vertical files has been arranged by the Dewey Decimal System in order to make it correspond with the classification of the books in the library, and with the mistaken idea that unless a decimal system is used there is no provision for subdivisions of a subject. The decimal system is too intricate for a subject vertical file; neither is it sufficiently expanded in many of the most vital subjects of today. Its use requires a complete author and subject catalog, which is not necessary for its class of material, and the making of which takes much time and thereby delays material from getting into circulation as quickly as possible. Another objection to the decimal system is that the catalog must always be consulted, as a key, before any material can be found, whereas the straight alphabetic subject arrangement permits of direct consultation of the files.

An arbitrary numbering, that is, a straight numerical system, has also been tried as a method of arranging this class of material, and it has many of the same objections that are found in using the decimal system, especially that of having to consult an index before being able to locate any material in the files.

A straight alphabetic subject arrangement is far superior to the decimal or numerical systems of classification. Its simplicity is its strongest recommendation. It is simple to prepare and simple to operate. It may be expanded indefinitely and it brings all subdivisions of a special subject together. It is intelligible to the uninitiated in library technique, that is, it is not an enigma to the business man who may want to get material from the files when the librarian is absent.

Time-Savers

There is also great saving of time in cataloging if the alphabetic subject arrangement is used. Under the decimal and numerical systems, not only must main author cards and analyticals be made for everything put into the files, but main subject cards also. With a straight alphabetic subject arrangement, only the briefest records are made which correspond to an abbreviated author card, and these only for important pamphlets and analytical subject cards. It is far safer to have these brief records of the information rather than omit them and depend on the memory and presence of the librarian for facts which in case of his absence may not be located. The main subject card is omitted because the pamphlets are filed in folders marked with the main subject name, and thus again time is saved by the elimination of the main subject card.

Various methods relating to the details of making these records, or the indexing and marking of the material for identification in filing, have been tried in many business libraries. After a careful study of these methods and the elimination of details that the writer believes are unnecessary or a duplication of records, the following rules are presented that have been found to give the maximum results with a minimum of effort. The adoption of these rules makes an accurate working reference file with as little expenditure of time and labor as is possible, at the same time making every bit of information accessible.

It is indeed necessary that the organizer of such information files be a trained librarian. It is necessary that he know thoroughly the principles of cataloging, as it is impossible to abbreviate methods unless they are understood in their entirety. It is necessary also to have knowledge and experience in assigning subject headings and the use of Cutter numbers. Added to this knowledge a keen interest in the company's business, with a close study and appreciation of its interests, will develop a business library with an information file that will render efficient worthwhile service.

Rules for Filing

Preparation of Material —

On receipt of material it is well to see that covers of pamphlets are intact and to mend torn leaves where necessary. If clippings are to be filed in the same folder with other printed matter, mount them and indicate source and date on article, if space permits, otherwise on the mounting, and stamp all material with the name of the library, with or without date of receipt. Bind articles and manuscripts as explained in article four of this series.

In all business libraries there are certain periodicals that will be bound, or kept permanently in pamphlet boxes for future reference, while others are not worth this expense, as they contain facts of current interest or only occasionally an article that seems worth indexing or clipping. In the case of the periodicals to be kept permanently, all articles of importance should be indexed immediately under their subjects and in the case of those that are eventually to be discarded, mark and index the article and indicate on outside cover the page number of article indexed and file the periodical in its pamphlet box. At the end of the year or when it is decided that these are no longer worth keeping, the librarian should go through the boxes, and aided by the notation on covers, clip articles of value for permanent filing and throw remainder of the periodical away. Sample periodicals and periodicals to which the library does not subscribe or has purchased because of a certain article, should be clipped immediately. The references to articles in periodicals may be made on a colored card to distinguish them from book and information file references.

Subject Headings —

Every piece of printed matter for the information files must be assigned a definite subject name. The pamphlet should be carefully examined or read and its main subject decided upon and notes made of other subjects of interest that it may contain. How close an analysis and how much indexing depends on the needs of the library and on who will use the files besides the librarian. The H. W. Wilson Company indexes are helpful in choosing subject headings, that is, the Industrial Arts Index, the Agricultural Index and the Public Affairs Information Service, all of which are published at 958 University Avenue, New York City. These indexes have been found more helpful in selecting subject headings for this class of material than The A. L. A. List of Subject Headings because they index from month to month the latest information not yet in books, and have therefore more detailed and up to date subject headings on facts of current interest.

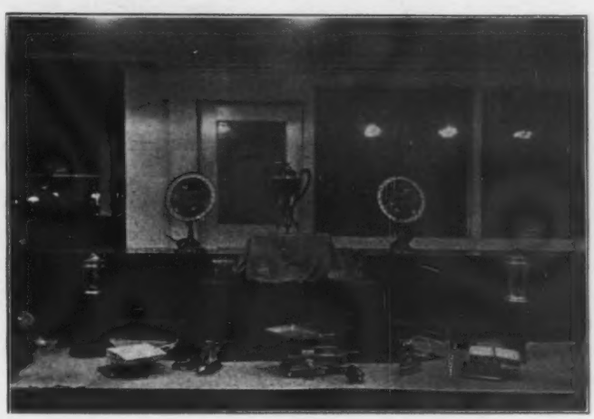
The Newark Public Library has published a small book called "List of Subject Headings for Information Files" that is a list used for their information files, and while it contains many subject names that are of only local interest or useful in a public library, it also contains suggestive subject headings for a business library.

It is always preferable to choose subject headings from indexes that are already prepared and in use. This aligns the information files of the individual business library with similar material in other libraries, and, as it were, standardizes the subject headings and makes the files easier to use in conjunction with other files and indexes. In addition to the subject headings found in these printed indexes each business library requires subject headings for its specific interests that are not found in printed indexes, or subjects that are not sufficiently expanded in these indexes to meet the need for detailed subject headings of specific interest to a particular business library. In such cases the librarian must study the needs of the organization, must also learn its vernacular and use the same terminology for specific interests as is used by the members of the organization. For example, "Bloats" and "Swells" are terms used in the canning industry to indicate defective cans of food and mean the same thing. But "Swells" is applied to cans of fruits and vegetables while the term "Bloats" is used for the same condition by the canners of milk.

Someone has suggested the use of the dictionary for choosing proper words for subject headings. Study the definitions and synonyms and select the word that most specifically expresses the subject of the material in question. Thomas' Register and Hendricks' Commercial Register may also prove helpful in selecting appropriate subject headings, though these are more helpful in assigning subject headings for trade catalogs than for information files.

It is necessary to keep at hand, where it may be quickly consulted, a list of the subject headings used in the files, in order to avoid assigning new terminology to the same subject and also to keep the subject terminology uniform. This list should always be consulted before assigning a subject heading, and is best made on the temporary index slips, L.B. catalog No. 1190 or 1192, and filed alphabetically in a cardboard box that may be kept on the librarian's desk or in desk drawer.

WINDOW DISPLAY IN PORTLAND STORE



The above is from a photograph of a window display of the Stubbs Electric Company, Portland, Oregon. Notice that the window is separated from the store proper by only a low partition—making the store also a part of the display. The bright metal of the appliances is thrown into striking relief by the heavy rich drapes on the pedestals.

SPARKS—Current Facts, Figures and Fancy

(The very latest reports from the railroad, airplane, oil and financial world appear on this page. If you are interested in the wide distribution of the electrical farm, in the production of eggs or in the waterfalls of Iceland, you will also find valuable data herein.—The Editor.)

The railroads of the country are planning upon a new supply of 1,800 engines, for which they expect to pay $100,000,000.

* * *

Hardly a day passes that does not bring a report of some new and novel application of electricity. The shoemaker's world is welcoming an electric heater devised to soften shoes so that they be easily lasted by hand or by machine.

* * *

If you can't find a home, go to Long Beach. This youthful city of southern California has passed Boston in her 1920 building activities. With a population of 55,593 she reached a total of $1,102,700 in building permits for October.

* * *

Even the waterfalls of Iceland are to be utilized in carrying out an extensive program of water-power development. The Icelandic Finance Minister is most optimistic concerning the future industrial development through the use of hydroelectric power.

* * *

Believing that it is more profitable to give than to receive, the United States is boasting of the fact that she is now the foremost lender of the world. A calculation places 13 to 15 billions as the minimum net amount of American credits extended to the world outside.

* * *

The California State Railroad Commission has authorized public utilities to issue securities totaling $1,001,500,000 during the past eight years. Gas and electric companies rank first in the amount of securities issued, with $398,000,000 against the steam railroads' $324,000,000.

* * *

Large quantities of food as well as other materials are required in the construction of a power house. According to the commissary's report 1,023,000 pounds of fresh meat, 57,000 dozen eggs, 900,000 pounds of potatoes and 75,000 pounds of coffee are among the items on the bill for the Caribou plant construction up to November 1.

* * *

Thanks to the inspiration of electricity, the wholesale production of eggs is becoming very popular. There is a hatchery in Montana which is most surely doing its bit to bring down the price of eggs. It has a capacity of 10,000 eggs which will be used to supply the Yellowstone and Glacier national park hotel systems with fresh eggs and poultry.

* * *

Reports from the airplane world are varied and encouraging. An aerial survey of the King's River mountain country is being made, looking to the development of hydroelectric power. A northern California physician finds the plane inestimably valuable in making rush calls, and one of our daring fliers enjoyed a three-hour trip from San Francisco to Los Angeles.

* * *

In France they find that there is enough power to run a turbine in a simple jet of water. The water from a reservoir 200 feet above the factory comes down through a vertical tube less than an inch in diameter. The strongest men cannot cut this jet with the best-tempered sword, and in some instances the blade has been broken into fragments without deflecting a drop of the water.

* * *

It's a bit hard to think of the electrical farm in Belgium but it is rapidly being located there, according to accounts which come from a recent commercial exhibition at a Brussels park. Electric washers, heaters, storage batteries and wiring devices received especial attention even from King Albert and the Queen and it is the general sentiment that farms should be restored on the modern electrical basis.

* * *

The enthusiastic inventor announces that we will soon have to drop the term, "boring for oil," because it may not be bored for any longer. An electrical device is predicted which will locate the oil because of the higher electrical resistance of oil as compared with other constituents of the earth. A circuit is formed by a series of batteries and a reduced deflection of a sensitive instrument in this circuit indicates the presence of oil.

* * *

Modern invention is rapidly robbing the sea of its mystery and its danger. The radio enables a ship to obtain its bearings at any time; the hydrophone, which utilizes the sound of the propeller reflected from the bottom of the sea, ascertains the depth of water at a moment's notice; hurricanes are detected long ahead of time by the radio telephones, and the captain is always fully informed as to the direction of storms and the location of icebergs and shipwrecks.

* * *

Predictions are being made that shortly California will take from Oklahoma leadership as the greatest oil producing state in the Union. Oklahoma's average is around 305,000 barrels per day, while in October California averaged 305,102 barrels a day. This figure and the promising fields now under development make the leadership prediction look highly probable. Twenty-five per cent of the oil pipe lines in the country are required to handle this California production.

PERSONALS

A. G. Wishon has recently been appointed vice-president and managerial director of the San Joaquin Light & Power Corporaton. Mr. Wishon has been connected with the San Joaquin Light & Power Corporation since its beginning, and is one of the pioneers of hydroelectric development in the West. He has been succeeded as general manager by **A. Emory Wishon** who for a number of years has been assistant general manager. These promotions were made necessary by the increase in size of the San Joaquin Light & Power Corporation which has recently added to its generating capacity, and is going ahead with an aggressive construction program. Both of these promotions are in the nature of a reward for the constructive work done by these men in the development of the San Joaquin company and the executive ability which they have displayed during the trying post-war period.

Claude C. Newkirk, manager of the Peet Bros. plant, has resigned his position to become the head of the new corporation which has purchased the Pacific Insulation and Refrigeration Company. The company expects to locate in Richmond.

R. E. Smith, acting secretary of the California Electrical Cooperative Campaign, has left the industry to accept a commission as Captain in the U. S. A. Corps of Engineers.

I. A. German, former sales manager of the Atlas Electric Company of Salt Lake City, has recently taken over the retail electric store known as Elder Brothers Electric Company, and has opened it under the name of "The Home Electric Company."

J. Waldo Smith, Chief Engineer of the Board of Water Supply of the City of New York was in San Francisco during the first part of this month. He addressed the members of the Engineers' Club and their guests on the water supply of New York City.

Commander Bryson Bruce, machinery division, Mare Island, has been appointed engineering officer of the superdreadnaught California. Mr. Bruce is reputed to be one of the most efficient engineering officers in the navy. Commander H. E. Brown, assistant to Bruce, has been named as his successor.

Huston Thompson, of Colorado, has become chairman of the Federal Trade Commission for a term of one year. Mr. Thompson, who was vice-chairman during the past year, succeeds to the chairmanship under the rule of the Commission which provides for rotation in the office of chairman among the several commissioners.

Carl C. Thomas, Western representative of Dwight P. Robinson & Company, Inc., recently consolidated with Westinghouse, Church, Kerr & Co., Inc., has left Los Angeles to report in New York on southern California conditions. Mr. Thomas has announced that the engineering and construction company which he represents is planning several huge projects which involve the development of water-power and irrigation. It is reported that the cost of completing these projects will run into millions of dollars.

W. D'A. Ryan, illuminating expert with the General Electric Company, is handling the lighting of Reparto Miramar, one of the finest residence districts in Havana, Cuba. There will be ornamental standards twenty feet in height, four to each central grass plot. The standard carries two, with a 1000-candlepower lamp in each globe.

Elwood Mead, Professor of Rural Institution in the University of California, and chairman of the State Land Settlement Board, has accepted an invitation from Governor Henry J. Allen of Kansas to address a conference of legislators and farmers on the California Land Settlement plan, at the State House, Topeka, Kansas, December 14. Enroute to the Kansas conference, Mr. Mead addressed a gathering of real estate men at Los Angeles, December 10th. Following the convention, he will speak at a conference at Minneapolis.

H. Foster Bain, consulting engineer, spent several days in San Francisco recently upon his return from the Orient, where he made extensive explorations in the interest of the Yunman Mining Corporation. Mr. Bain was at one time editor of the Mining and Scientific Press and during the war, assistant director of the Bureau of Mines. At the present time many are hoping that Mr. Bain will accept a recent appointment as director of this bureau.

Henry Bostwick has been made manager of the San Francisco division, in connection with the recent reorganization of the Pacific Gas & Electric Company, effective December 1; **John D. Kuster,** of the San Jose division; **Lee H. Newbert,** of the East Bay division; **H. G. Ridgway,** of the North Bay division; **E. W. Florence,** of the Sacramento division; **Chas. S. Northcutt,** of the San Joaquin division; **H. M. Cooper,** of the Drum division; **E. C. Johnson,** of the Colgate division; **I. E. Adams,** of the DeSabla division; **H. B. Heryford,** of the West Side division; **G. R. Milford,** of the Shasta division, and **H. C. Ross,** of the Fresno division.

Burrell S. Manuel has been appointed general manager of the Electric Railway and Manufacturers' Supply Company of San Francisco. Mr. Manuel is a Westerner, having received his training in the electrical industry in Denver, Colorado, with the Mountain Electric Company with whom he started to work in 1901. From 1904, when the Westinghouse Electric & Manufacturing Company opened an office in Denver, until 1918 he was connected with this office, acting as manager. In 1918 Mr. Manuel was moved to East Pittsburgh as manager of the appliance section of the company which handled fan motors, heating appliances and ranges. The following year the heating appliance business increased to such an extent that he was moved to Mansfield to take charge of the Westinghouse Electric Products Company, from which position he came West to become general manager with the Electric Railway and Manufacturers' Supply Company. The electrical industry is glad to welcome him to the Pacific Coast, and wishes him all success in the new position he is so well fitted to fill.

DO YOU REMEMBER

—**that 25 years ago it was feared that the Welsbach burner would prove a dangerous rival to the incandescent lamp and would eventually supplant it for home lighting?**

Floyd N. Averill, manager of the Fobes Supply Company of Portland, Oregon, has been appointed chairman of the recently formed finance committee of the Northwest Electric Service League. This definite step toward putting the League into active operation follows the successful series of "barnstorming revivals" which have broken preliminary ground for the work in the state of Washington. Oregon has already laid the foundation for an enthusiastic support of the movement, largely through the effective work of both the contractor-dealers' organization and that of the electrical supply jobbers of Portland, who have for some time been working closely together toward the betterment of the industry. The personnel of this important committee who will work under Mr. Averill's leadership is announced elsewhere in this issue.

Corliss A. Berclaw, representative of the Educational Department of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, visited in San Francisco during the past week and has now gone to Los Angeles.

Carl F. Uhden, Assistant City Engineer of Seattle, in charge of construction activities on the Skagit Power Project for the City of Seattle recently addressed the Municipal League of Seattle on "Status of Work at the Skagit."

L. A. Lewis, of the Washington Water Power Company, of Spokane, was a recent Seattle visitor. He took a very prominent part in the launching of the Northwest Electrical Service League and banquet held on the evening of November 29.

R. T. Stafford, Manager of the Allis-Chalmers Manufacturing Company's Seattle office, recently made a short trip to Victoria, B. C., coming home via Vancouver where he visited and attended to business in the Vancouver offices of that company.

Al Dodge, well-known construction engineer, who has been in charge of the building of the Southern Railway in China, returned during the past month and announces that the civil war in China has caused a temporary delay in the continuance of this work.

L. W. Chapman, Pacific Coast editor of Chemical and Metallurgical Engineering, is traveling over the Owens Valley, California, and parts of the state of Nevada, with a view to studying the industries engaged in extracting the various chemical salts from the alkaline soils of those regions.

W. J. Grambs, Manager of Auxiliary Operations of the Puget Sound Power & Light Company, was the guest of honor at a dinner given at the Seattle Board's Merchant Marine Training Station in recognition of his work during the World War as supervisor of the recruiting service of the United States Shipping Board. Mr. Grambs was presented with a beautiful bronze ship's clock and barometer combined as a token of the esteem with which he is held by his former associates in the service.

Fred M. Abbott, who has been special investigator and safety inspector for the public utilities commission of Utah for the past three years, has tendered his resignation. Mr. Abbott, in addition to his investigating work, has had charge of executing the wishes of the commission with regard to general safety conditions. His work has attracted the attention of the claims departments of some of the larger railroad lines, and he has received several offers of positions with them. He has not yet announced what his future plans are.

Samuel Kahn, vice-president and general manager of the Western Gas and Electric Company, Stockton, California, spent several days in San Francisco recently.

J. V. Baum, stoker engineer of the South Philadelphia works of the Westinghouse Electric & Manufacturing Co., is in the Northwest in the interests of the stoker business of his company.

F. M. Kerr and **H. H. Cochrane,** vice-president and manager and chief engineer, respectively, of the Montana Power Company, are spending some weeks in the Eastern offices of that company.

Fletcher Hamilton, State Mineralogist, and **W. W. Thayer,** of the California Mining Bureau, have returned to San Francisco after a two months' trip which covered every county in California, and which was taken for the purpose of arousing the public to the necessity of supporting the measures of relief for gold mining which are embodied in the McFadden Bill. This bill was introduced, but not acted upon by the last Congress, and provides for an excise tax of $10 an ounce on new gold in manufactured articles. It seems that never before in the history of the state was the gold mining industry in such an unsatisfactory condition.

Arthur R. Kelley has joined the organization of the Southern California Edison Company in charge of the newly established department of Estimates and Valuations. Mr. Kelley graduated from Purdue University in 1903 with the degree of B.S. in electrical engineering and followed this with the two-year apprentice course with the Western Electric Company in Chicago. Mr. Kelley served successively as local manager of the Citizens' Telephone Co. of Anderson, Indiana; electrical engineer for Seattle, Renton and Southern Railway of Seattle; assistant engineer for the Public Service Commission of the state of Washington; electrical engineer for the California Railroad Commission, where he organized a department for handling appraisals, and since 1914 has been in private practice as consulting engineer with headquarters in San Francisco, specializing on valuations of public utility properties. During the war Mr. Kelley was commissioned Captain of Engineers, assistant to Major Geo. W. Seever, power administrator for California, Oregon and Washington, under the Power Division of the War Industries Board.

OBITUARY

Raphael Weill, president of Raphael Weill & Co., Inc., of San Francisco, died December 9th in Paris. Raphael Weill, a native of France, has been prominent in San Francisco civic life for sixty-five years and his death breaks one of the cherished links between the present day and the famous "days of gold."

James W. Bell, vice-president of the Wagner Electric Manufacturing Company of St. Louis, and one of the pioneer capitalists of the electrical industry, died in St. Louis during the early part of November.

Benjamin Holt, president of the Holt Manufacturing Company, inventor of the caterpillar tractor, and a leader in the development of the tanks which took such a great part in the war, died in Stockton on the fifth of December. Mr. Holt stands among the most honored of Western men because of his contribution to agriculture and the upbuilding of Western industry.

HAPPENINGS IN THE INDUSTRY

ASSOCIATION OF UTILITY COMMISSIONERS CONTEMPLATED

Members of the public utilities commissions of Utah, Nevada, Montana and Idaho have recently concluded a conference at the state capitol in Salt Lake City with a general discussion of problems common to all. The matter of express rates, which was one of the reasons for the calling of the conference, was left to the individual commissions to decide, in the light of what had been brought out by the discussions at the conference.

The commissioners found, however, that the exchange of ideas and general discussions at the present conference had been so helpful and beneficial that the proposition of forming an inter-mountain association of utilities commissioners was favored.

In the absence of other members of the visiting commissions no action could be taken. It was left with Judge Joshua Breenwood, president of the Utah Commission, to correspond with other commissions to ascertain if some sort of an association of the kind suggested would be agreeable to all.

BILL FOR NATIONAL PARKS

Secretary Payne has recommended to Congress, legislation to exclude national parks from the provisions of the water power bill. The bill drafted by the secretary provides that permits for such developments may be secured only by special acts of congress.

CARIBOU TUNNEL COMPLETED

Work of boring tunnel No. 2 of the Great Western Power Company's Caribou project was completed December 1, according to a recent report. This tunnel, which is 9,200

Interior view of the Caribou tunnel under construction

feet long, begins in Butt valley and goes through the ridge to a point 1100 feet above the Caribou power plant.

This will enable the plant, which has a capacity of 60,000 horsepower, to begin generation of electricity early in February.

PERMIT ASKED FOR PIT RIVER DEVELOPMENT

The Pit River Power Company has applied to the Federal Water Commission in Washington for a preliminary permit to go ahead with power development on Pit River above Copper City. The Commission has set February 10 as the time for considering the application and hearing any objections that may be made in the meantime.

LOS ANGELES ELECTRICAL HOME

Thirty electrical appliances were demonstrated to the Los Angeles public in this home from November 12th to 28th. The keen interest in the electrical home idea which was aroused here will undoubtedly serve to give the larger home, which is to be opened January 15th unprecedented popularity.

WASHINGTON ADVISED OF FILING ON POWER PROJECT

The federal water power commission has advised Gov. Hart, of Washington, of the filing of an application by the Washington Irrigation and Developing Company of Seattle for a preliminary permit for a power project on the Columbia River at Priest Rapids. This company, of which Henry J. Pierce is president, plans to spend $150,000,000 in the development of power at Priest Rapids, rivaling that at Niagara Falls.

Upon advice of the State Attorney-General that under provision of the federal water power act the state is given preferential right to potential water in its borders, the governor has notified the state hydraulic engineer, the state reclamation board and the Columbia Basin survey commission of the situation in order that an investigation may be made to ascertain whether the state desires to make filing at this point.

ELECTRICAL CODE FOR NEVADA FORMULATED

At a recent meeting of electrical engineers, held in Reno, regulations governing construction operation and maintenance of overhead and underground electrical wires in Nevada were discussed. The rules have been approved by the public service commission and will become the code for use in Nevada as soon as sufficient books are printed for general distribution.

The regulations were prepared by a committee appointed by the public service commission. The following were members: F. O. Broil, engineer for the commission; E. D. Brown, representing the power companies, and R. W. Mastick of the Bell Telephone Company, representing signal utilities. Two laboring men were also members.

DO YOU REMEMBER

—when in 1896 contracts were being let for the Big Creek development, a 150-kw. plant to furnish power to the city of Santa Cruz, California?

SUPREME COURT ORDERS RE-HEARING OF "SPECIAL CONTRACT" CASES

In the special contract cases, in which the Public Utilities Commission of Utah recently handed down a decision whereby a number of large power customers of the Utah Power & Light Company, who are holders of "special contracts" with that company, were placed on standard schedules, two of the customers—namely, the United States Smelting, Refining & Mining Company and the United States Fuel Company—have obtained from the Supreme Court of Utah a writ of certiorari directed to the Public Utilities Commission. The writ is made returnable December 16, which means that under the rule of the court the matter will be argued at that time. In the event other customers take similar action against the Commission, the Supreme Court may set a later date for the hearing of all the cases at the same time.

The order of the Public Utilities Commission denying a re-hearing in the power contract cases was issued on November 10 and the companies have thirty days, under the law, in which to apply for writs of review.

COURSE IN ELECTRICITY OFFERED IN IDAHO

The Idaho Technical Institute is offering a course in practical electricity. This course is given especially for men who are in the trade or are interested in following the trade. Professor Ralph H. Walters, a member of the Electricians' Union and an expert electrician, will give the course. The entire equipment of the Idaho Technical Institute electrical laboratory is available.

CITY AND GOVERNMENT MAY JOIN IN SOUTHWEST DEVELOPMENT

Los Angeles city officials have been in conference with Arthur P. Davis, director of the United States Reclamation Service, outlining a program for the development of municipal hydroelectric power in conjunction with a gigantic government scheme for reclamation of desert lands.

The discussions included the joint undertaking by the United States government and the city of Los Angeles of the impounding of hundreds of acres of water from the Colorado River and the Mono watershed.

It was pointed out that the two schemes would bring the reclamation of millions of acres of arid lands in California, Nevada, Arizona and possibly Utah, and give to Los Angeles additional power plants, totaling a development of 620,000 horsepower.

ELECTRICAL SHOW HELD IN VANCOUVER

Vancouver, B. C., held its first electrical show under the auspices of the British Columbia Electrical Cooperative Association from November 22 to 27, during which time it was visited by ten thousand people. The show was placed under the management of E. E. Walker, sales engineer, British Columbia Electric Railway Company and chairman of the Advisory Council of the B. C. Electrical Cooperative Association, with J. F. Little, local manager of the Northern Electric Company, as assistant manager. The other members of the committee were:

E. Brettell, display and decoration; W. W. Fraser, illumination; J. Muirhead, light and power supply; E. H. Hughes, entertainment; W. C. Mainwaring, space allocation; J. Lightbody, publicity, and H. Pim, finance. The firms exhibiting were: British Columbia Electric Railway Company, Canadian General Electric Company, Northern Electric Company, Electric Supply and Contracting Company, Western Power Company, Hoover Suction Cleaners, Kanaly's Ltd., Jarvis Electric Company, W. W. Fraser, E. B. Horsman & Son, Rankin & Cherrill, B. C. Telephone Co., Modern Utilities Company, Percy Letts, Perry Electric Co., Farr, Robinson & Bird, Crossman Electric Co., The Electric Shop, and Muir Electric Co.

The show entailed an expenditure of nearly $8,000, some of which was defrayed by gate admissions, some by the rental of space and the balance was a deficit against the Association.

ONE HUNDRED THIRTEEN APPLICATIONS FOR POWER PROJECTS FILED

One hundred and thirteen applications for permit or license for power development have been filed with the federal power commission, it was announced December 9.

Among the appliuations recently received were:

Five dams, four reservoirs and two power houses in head waters south fork, San Joaquin river, Southern California Edison Company, Los Angeles, Cal.

Dam on Colorado river at Lee's ferry, Arizona, creating a reservoir extending up-stream 300 miles and controlling annual flow of river, Southern California Edison Company.

DREDGING OF SAN FRANCISCO WATER FRONT CONSIDERED

Development of the Islais Creek-India Basin district of San Francisco's water front, rendering 280 acres of submerged land useful to commerce and industry, is urged by the Board of State Harbor Commissioners, who have placed their case before the United States District Engineer preliminary to obtaining an appropriation from Congress for the dredging of this area.

Ultimately, the improvement will provide berths for forty-nine steamships, each 500 feet in length, and six berths for vessels 300 feet in length.

RECLAIMING THE DESERT

During the last five years over one hundred and fifty miles of power distribution lines have been built in the Antelope Valley, the western boundary of the Mojave desert, and electric pumping and irrigation has now raised the value of the property from $40 to $500 per acre. The principal crops are alfalfa and Bartlett pears.

RESOLUTION FOR THE BENEFIT OF THE INVESTING PUBLIC

The Central States Group of the Investment Bankers' Association of America, comprising the states of Illinois, Wisconsin, Indiana and Iowa, urges the sane, sober business men and women of Illinois to safeguard the State Public Utilities Commission.

Following the precedent established last spring by the governing body of the entire association, the executive committee of the Central States Group has adopted the following resolution:

"**Be It Resolved,** That the Executive Committee of the Central States Group of the Investment Bankers' Association of America views with great apprehension any attack upon the principle of commission regulation of public utilities, knowing that such public utilities are owned, not as popularly supposed, by a few people, but by thousands of investors whose savings are invested in such public utilities, either directly or through savings banks and insurance companies, and that such savings will be imperiled and the service of such utilities to their respective communities hampered, and strongly advises the people of Illinois to safeguard their present public utilities law in every possible manner and make clear their determination that this modern, progressive, economically scientific method of administering the public utilities of their state shall not be tampered with."

CONTROVERSY OVER CUSHMAN POWER SITE

The city of Tacoma recently began, in the Superior Court at Shelton, Washington, its fight to secure the right to condemn property in Mason county for the development of the Lake Cushman power site, which the city has a contract to purchase. A lively fight by the Frank McKean interests, rival power claimants, is promised before the case is concluded. The city, through its Superintendent of Lighting, Llewellyn Evans, has produced evidence to show that the city is now using nearly the maximum capacity of the La Grande plant for lighting and other public uses, and that increase of the La Grande plant cannot be economically accomplished.

SAN DIEGO CONSOLIDATED PLANS PURCHASE OF PLANT

The San Diego Consolidated Gas & Electric Company is planning to purchase from the San Diego Electric Railway Company the power plant owned by the street railway company in the city of San Diego, according to an application filed with the California State Railway Commission by the railway company. The price to be paid for the power plant is given as one million dollars. According to the application filed, it is the purpose of the railway company to purchase from the San Diego Consolidated Gas & Electric Company power with which to operate its electric lines, the rate to be paid to be fixed by the Commission.

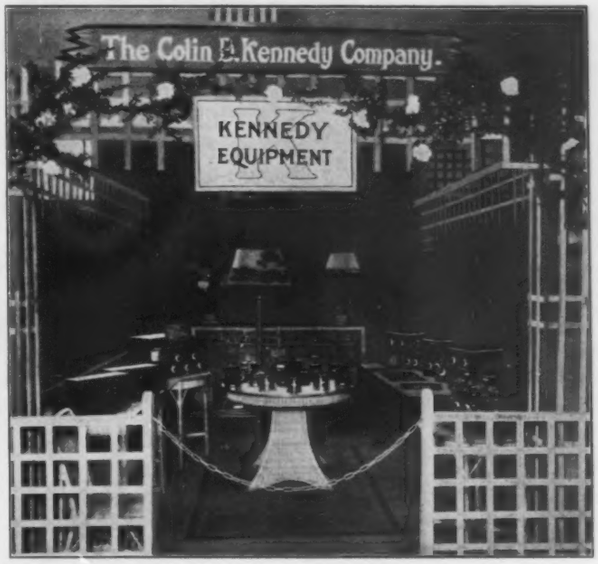
A NEW NORTHWESTERN ELECTRICAL STORE

Interior of the Pioneer Electric Company's store, recently opened in Port Angeles, Washington. One of the devices employed to attract a crowd on the opening day was a performance by a Marathon pianist, who played continuously for thirty-six and one half hours. The proprietor of the store, A. L. Phillips, is shown standing in the foreground, second from the left.

SERVICE STATIONS SHOWN ON MAP

The Westinghouse Electric & Manufacturing Company, Springfield, Mass., has issued a map of the United States measuring 9 by 12 inches which shows the transcontinental highways in heavy black lines, the interstate auto routes in light red lines, and the location of its service stations. On the back of the map is a description of the starting, lighting and ignition equipment which this company manufactures.

THE PACIFIC COAST RADIO SHOW



This exhibit of the Colin B. Kennedy Company radio receiving apparatus attracted considerable attention at the Pacific Coast Radio Convention which was held in San Francisco during the latter part of November. The outstanding result of this convention was the conviction that some dependence on Eastern manufacturers of radio equipment is no longer necessary. It was evident that the standard exhibited by apparatus of Pacific Coast manufacture compared most favorably with that produced in Eastern centers.

COMPARATIVE COST OF MELTING BRASS IN ELECTRIC FURNACE AND GAS FIRED CRUCIBLES DURING JUNE, 1919

	Electric Cost per Ton Melted	Gas Cost per Ton Melted
Pounds of metal poured during month	35,215	18,210*
Electric energy (480 kw-hr.)	$13.64	.....
Gas (18,600 cu. ft.)	.....	$12.65
Labor	6.25	8.00
Lining	1.00	1.00
Crucibles	.....	7.00
Metal shrinkage:		
Electric, 1.31 per cent, at 18 cents	4.71	.....
Gas, 2.62 per cent, at 18 cents	4.71	.....
Electrode consumption at 27 cents per lb.	1.08	.....
Gas for heating ladle, 600 cu. ft. at 68 cents per 1000 cu. ft.	0.41	.....
Total	$27.09	$38.07
Saving by use of cheaper scrap made possible by electric furnace	2.88	.....
Average net melting cost	$24.21	$38.07

Average saving per ton melted in electric furnace, $13.86.

*Estimated.

DO YOU REMEMBER

—that in 1898 the Pacific Electric Transmission Association, the forerunner of the Pacific Coast Section N. E. L. A., adopted its constitution at an open meeting held in the Crocker Building, San Francisco?

REVIEW OF POWER, OIL AND GASOLINE SITUATION BY PROMINENT BANKER

The outstanding features of a study which W. W. Woods of the First National Bank of Los Angeles has been making of the power, oil and gasoline situation on the Pacific Coast are being sent to the larger power companies of California by the Pacific Coast N. E. L. A. Public Relations Committee, and a request is being made to distribute this material among the newspapers in the respective territories.

"The final census statistics for 1920 give California a numerical increase in population over 1910 of 1,048,987. At the same time the power consumed in California has jumped from 1,250,000,000 kw-hr. in 1910 to 3,750,000,000 kw-hr. in 1920.

"This means that the demand for power has increased not alone at the same rate of population increase, but to a much greater extent, and there is not a man or woman in California today who does not know of the power shortage which California has faced during the last two years, or who has forgotten the oil and gasoline shortage of three months ago. This year 50 per cent more wells were required to produce practically the same amount of oil as that produced five years ago.

"California's oil consumption is outrunning her production at the rate of more than 10,000,000 barrels a year. This can only mean that as the population increases and as demands for fuel also increase, the price of fuel oil and gasoline will mount so rapidly that this state must inevitably turn largely to some other fuel for its power. No influence on earth save rationing the supply, can keep the present prices stationary.

"When the point was reached in any city where it would be difficult to obtain the necessary driving force for factory wheels, the contracts were placed elsewhere, and what was true for war, by order, must, by force of economic conditions, become the basic industrial law in California within the next ten years.

"It is for this reason that those who have the interest of this state at heart are particularly anxious that the hydroelectric programs of the various power companies may not be held up and also that such organizations as the Union Oil Company of California, which has announced a program of ship construction to bring into California from Mexico the necessary fuel oil to make up at least a part of our own shortage, may have the full support not only of the business interests but of the whole people of the state."

DEMAND FOR P. G. & E. STOCK

Sales of the Pacific Gas and Electric Company's first preferred stock on the recent offering have passed the $3,000,000 mark. Up to the close of business on December 9, 2834 sales, aggregating in all $2,999,000, had been closed.

The total number of stockholders as of that date, was 13,112, of which 10,273 were holders of the preferred and 2839 of the common stock.

These figures show that the company's preferred stockholders have increased in number eight-fold since Vice-President Hockenbeamer inaugurated his "customer ownership" plan on June 3, 1914.

Public utilities in various parts of the United States have placed more than $100,000,000 worth of securities with their customers since the "Hockenbeamer" plan was first put into operation in California.

PUGET SOUND NOTE ISSUE

The Puget Sound Power & Light Company is offering for sale to its patrons and the investing public another $1,000,000 of its 8 per cent, five-year gold coupon notes, This is the second million dollars of an authorized issue of $2,000,000 of these securities. The first million dollars' worth was sold in September of this year.

SAN JOAQUIN BOND ISSUE AUTHORIZED

Authorization has been given to the San Joaquin Light & Power Corporation by the State Railroad Commission to issue $2,625,000 in bonds to pay notes and expenses connected with construction work at Bakersfield and at the Kerckhoff hydroelectric plant.

SOUTHERN SIERRAS BOND ISSUE

A Railroad Commission order issued recently authorizes the Southern Sierras Power Company to issue $1,040,478.55 of its first and refunding 6 per cent bonds for the purpose of financing in part the cost of plant extensions, additions and betterments.

MOUNT SPOKANE COMPANY BOND ISSUE

The Mount Spokane Power Company which supplies Deer Park, Milan, Chattaroy, and Denison near Spokane has made a $20,000 bond issue. Mark Mendenhall, president of the company, recently said: "We are now completing the plans for rebuilding and enlarging the lower and older plant of the company which will give the two combined plants a capacity of 650,000 horsepower."

WESTINGHOUSE CAPITAL AND INDEBTEDNESS INCREASED

At the special meeting of the stockholders of the Westinghouse Electric & Manufacturing Company, at East Pittsburgh on November 18, an increase in the indebtedness of the company by the sum of $30,000,000 was authorized. Also the stockholders in this meeting voted to authorize an increase in the capital stock of the company from $75,000,000 to $125,000,000.

COAST VALLEYS GAS & ELECTRIC COMPANY NOTE AND BOND ISSUE

Coast Valleys Gas & Electric Company has been authorized to issue $375,000 of its first mortgage bonds and $220,000 of its 10-year 8 per cent notes. The bonds are to be sold at not less than 80 per cent of their face value and the notes at not less than 94. The moneys obtained through the sale of the notes are to be used by the company to pay the cost of plant extensions, additions and betterments. A supplemental order authorized the company to issue $125,000 of its bonds at 80 per cent of their face value.

TRADE NOTES

This Year's Lamp Sales Expected to Reach 230,000,000 —

Lamp manufacturers are working to capacity to fill the existent demand and are finding it possible now to make satisfactory shipments. From estimates which have been made at this time it appears that total sales of large lamps, tungsten and carbon, will amount to approximately 230,000,000 for the year 1920. Of this amount sales of carbons will account for about 15,000,000 lamps. This leaves 215,000,000 tungsten vacuum and gas-filled lamps of the large size, which, compared to sales for the year 1919, shows an increase of 38 per cent for the present year. Miniatures will probably total just over 100,000,000 lamps.

Fairbanks, Morse & Co. Purchases Company —

Fairbanks, Morse & Co. have purchased the entire business consisting of all stock on hand, good-will and liabilities of the Luster Machine Shop and Railway Equipment Co., Philadelphia. Fairbanks-Morse have opened a new branch at this address under the management of Mr. D. W. Dunn.

Pacific Coast Office Established —

The Starr Brass Works, manufacturers of the "Sprarite" spray cooling systems, Chicago, Ill., announce a Pacific Coast office in the Rialto Building, San Francisco.

Electric Furnace Installation

Robert L. Rockwell, consulting engineer of Seattle, has recently completed plans and specifications for a modern electric steel furnace installation for the new foundry of the Deud-MacFarlane Machinery Co., Tacoma, Washington.

Radio Specialties to be Produced in New Shop —

With the perfection of radio telephones has come an increase in demand for delicate electrical instruments. This demand is being met by the Western Electric Company, the oldest manufacturers of telephone equipment in the world, by the establishment of a factory at Philadelphia where instruments of extreme sensitiveness are made.

Meeting Notices for Electrical Men

(Preliminary plans for the 1921 Pacific Coast Section N. E. L. A. Convention are announced below, along with the report of the recent Executive Committee meeting. Industrial illumination is prominent among the subjects discussed at the various engineers' meetings and important organization news is included in recent Northwest meeting reports.—The Editor.)

N. E. L. A. Executive Committee Decides Convention Date

The meeting of the Executive Committee of the Pacific Coast Section, N. E. L. A., decided that the annual convention of the Pacific Coast Section N. E. L. A. should be held at Del Monte, May 25th to 27th inclusive, and that free copies of the "Electrifier" should be sent out between the present time and the date of the convention. The question of the finances of the Pacific Coast Section was discussed and plans were made to carry on the work of the Pacific Coast Section until the first of the year, when it could expect financial help from the national body.

Mr. Robert Sibley, editor of the Journal of Electricity, was elected to serve on the Executive Committee in place of Mr. W. M. Deming, who has resigned from the technical press and moved to Tennessee. Lee H. Newbert, division manager, East Bay Division, Pacific Gas & Electric Company, as president of the Pacific Coast Section is chairman of the committee. The other members are:

Wm. Baurhyte, vice-president Los Angeles Gas & Elec. Corp., Los Angeles; S. J. Lisberger, chief of division of electric distribution and steam engineering, Pacific Gas & Electric Co.; A. H. Halloran, Pacific Coast Dept. McGraw-Hill Book Co.; E. B. Criddle, general agent, Southern Sierras Power Co., Riverside; A. B. West, vice-president and general manager, Southern Sierras Power Co.; Henry Bostwick, Pacific Gas & Electric Co.; R. E. Fisher, manager commercial department, Pacific Gas & Electric Co.; S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco; J. B. Black, general sales manager, Great Western Power Co., San Francisco; A. G. Wishon, general manager, San Joaquin Light & Power Corp.; D. E. Harris, Pacific States Electric Co., San Francisco; R. A. Balzari, manager industrial division, Westinghouse Electric & Manufacturing Co.; J. A. Britton, vice-president and general manager, Pacific Gas & Electric Co., and W. M. Shepard, commercial manager, California-Oregon Power Co., San Francisco.

BUILDERS OF THE WEST — XCI

ARTHUR P. DAVIS

The reclamation policy of the United States Government has made possible the development of immensely fertile areas in the West through vast irrigation projects carried out on a scale impossible to private enterprise and with a vision and daring which have resulted in the breaking of more than one world's record in engineering achievement. To Arthur P. Davis, director and chief engineer of the U. S. Reclamation Service and president of the American Society of Civil Engineers, this issue of the Journal of Electricity is affectionately dedicated in acknowledgment alike of his personal achievements in Western engineering and of his constructive work in directing this building of an empire from the arid West.

Scientific Illumination and Northwest Development Discussed Before Joint Meeting at Portland

A paper on "Scientific Illumination and Its Practical Applications" was presented by F. H. Murphy, illuminating engineer, of the Portland Railway, Light & Power Company, before a recent joint meeting of the Portland Sections, A. I. E. E., N. E. L. A. and Contractor-Dealers.

The paper dealt with the theory of radiant energy, the complexity of the structure of the eye and the construction and efficiency of the modern incandescent lamp. Following the presentation of this paper, the conditions which obtain in the average poorly lighted machine shop in contrast to those which may be found in a modern well lighted industrial plant, were shown by a lighting exhibit installed especially for the occasion. So much enthusiasm has been stirred up that there is a movement under way to establish a permanent lighting exhibit.

G. E. Armstrong, Pacific Coast editor of the Electrical World, who has been spending some time in New York and has just completed a tour of the Northwest, gave a most interesting talk at the "Northwest Development" meeting held November 23. He said that the Northwest, and Portland in particular, has suffered less business depression than most any other section. Mr. Armstrong attributes present conditions to the consumers' strike, no foreign markets, holding of agricultural products and the unemployment of labor. He feels optimistic over industrial development and the growth of the electrical industry in the Northwest, and advocates inter-connection of power systems as a solution to the economic development of the water power in this section.

Future programs planned are: "Electrical Engineering Progress in the West," by Robert Sibley, "Water Power Development," by Franklin T. Griffith, and "Public Utility Financing," by Geo. L. Myers.

Los Angeles Section, A. I. E. E.

With a record-breaking attendance the Los Angeles Section of the American Institute of Electrical Engineers put over the second big meeting of the year on the evening of November 23. Addresses were given by H. A. Barre, executive engineer for Southern California Edison Company, and R. C. Starr, construction engineer for the San Joaquin Light & Power Corporation.

Mr. Barre's subject was "The Edison Plan—an Adventure in Democracy." After an introduction outlining the physical and financial features of the Edison power program at Big Creek, Mr. Barre discussed what he termed the "human plan." He mentioned the Reward for Efficiency idea as advanced by Commissioner Edgerton at the Pasadena convention and showed how great operating records could be made by a company adopting such an idea as an incentive to its employes to do their best at all times.

Mr. Starr's subject was "The Kerckhoff Power Development." According to his statements, this is the first unit of the greater San Joaquin plan, which contemplates the development of new hydroelectric plants at the rate of 30,000 horsepower a year for the next five years, and then at the rate of 50,000 horsepower annually for the succeeding five years. Most of this will be on the Kings River.

DO YOU REMEMBER

—in 1898 when wireless telegraphy was demonstrated at the Trans-Mississippi Exposition at Omaha—and there was doubt whether Marconi should be given credit for the invention?

Oregon Contractors and Dealers to Organize Branch in Salem

A meeting was held in Salem on December 7 for the purpose of organizing an active branch in the third district of the Oregon Association of Electrical Contractors and Dealers, at which time district officers and a representative to serve on the executive committee of the State Association was elected.

F. S. Barton was elected district representative on the State Executive Committee. The members of the District Executive Committee were elected as follows: J. H. Ralston, Albany, W. G. Cummings, Corvallis, W. H. Welch, Salem, and F. B. West, Dallas.

At the annual convention of the State Association held in Portland in October, it was decided to re-district the state, making seven districts instead of three as heretofore, and plans are now under way to establish active branches in the six districts outside of Portland, in order that the members in the various districts may have the benefits of district meetings, which make for better cooperation and which will facilitate the work of the Northwest Electric Service League. It is planned to organize the other districts within the next two months.

The district chairman and secretary will be elected at the first meeting of the Executive Committee.

Denver A. I. E. E. Visits Sugar Plant

The workings of electric power in the manufacture of sugar were studied by the members of the Denver Section, American Institute of Electrical Engineers, on the afternoon of December 11 when they visited the Brighton Plant of the Great Western Sugar Company. After the trip a dinner was given at the Metropole Hotel and B. Hutchins, traveling superintendent for the Great Western Sugar Company, gave a very interesting address.

Industrial Illumination Presented by Illuminating Engineering Society

"The What and Why of Industrial Illumination" is the title of the address being presented by Otis L. Johnson at the December 15 meeting of the San Francisco Bay Chapter of the Illuminating Engineering Society. Mr. Johnson is illuminating engineer for the Benjamin Electric Manufacturing Company, Chicago, and national vice-president of the Illuminating Engineering Society. Invitations to this meeting have been extended to the American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Architects, San Francisco Society of Architects and the American Association of Engineers.

Hydroelectric Development Is Subject of Joint A. A. of E. and Commercial Club Meeting in Fresno

At a November meeting the Fresno branch of the American Association of Engineers held open house with the Commercial Club. Mr. E. C. Smith, president of the branch, introduced the speakers and explained the purpose and ideals of the association for the benefit of the general public in attendance.

Rex C. Starr, construction engineer with the San Joaquin Light & Power Corporation, spoke on recent hydroelectric developments, illustrating his talk with slides showing the construction of the Kerckhoff dam and power house.

B. F. Jacobsen, designing engineer with the San Joaquin Light & Power Corporation, gave a short talk concerning the advantage of developing hydroelectric rather than any other kind of power. He said that, unlike other means of power generation, the power in our streams is being created anew every year, and when we use it we are not drawing upon any limited supply.

This meeting was another of the important steps being taken to make the story of hydroelectric development popularly understood.

Committee Appointed by N. E. L. A. Public Policy Committee

At a recent meeting of the Public Policy Committee of the National Electric Light Association all activities of the Association were reported upon, discussed and approved. Financial matters were discussed, and Chairman McCall of the Finance Committee reported that satisfactory arrangements had been made to carry on the work of the Association pending receipt of the new dues in 1921.

President Insull of the Association was authorized to appoint a committee to cooperate with other public utilities in presenting public policy matters to the public.

Chairman Mitchell was authorized to appoint a committee to represent the N. E. L. A. at the Washington convention of the National Association of Railway Utilities Commissioners. The ex-officio members of this committee were designated as Chairman Mitchell, President Insull and Executive Manager Aylesworth.

In the afternoon representative bankers, investment bankers, manufacturers, business men and representatives of the American Gas Association and the American Electric Railway Association attended an open meeting of the Public Policy Committee, at which time all phases of the present public utility situation were discussed.

Northwest Electrical Service League Appoints Finance Committee

At a meeting of the Advisory Committee of the Northwest Service League, held in Seattle November 29, a committee to finance the work of the League was appointed, consisting of:

F. N. Averill, Fobes Supply Company, Portland, chairman; A. S. Moody, General Electric Company, Portland; L. A. Lewis, Washington Water Power Company, Spokane; John V. Strange, Pacific Power and Light Company, Portland, and A. J. Gladson, contractor-dealer, Yakima, Washington.

This committee will immediately set out to raise funds for the conduct of the work of the League for the year 1921.

San Francisco Electrical Development League Holds Joint Meeting with Purchasing Agents

The November 22 meeting of the San Francisco Electrical Development League was in conjunction with the Purchasing Agents' Association. The speaker of the day was Mr. G. B. Gray, the chairman of the Purchasing Agents' Association, who spoke briefly on the importance of the purchasing agent and the necessity for good judgment on his part. R. A. Balzari, manager of the power department, Westinghouse Electric & Manufacturing Company, told of impressions received while on a visit in the East. He stated that labor is becoming more efficient, this being noticeable in a certain factory which wished to cut production and so dropped two hundred girls. Instead of the production dropping off, it remained at the same point. The next speaker was D. W. Stands, purchasing agent of the California Central Creameries, who summed up general business conditions by stating that the trend of prices is now toward a lower level and that while the buyers are hesitating to buy on the declining market and the manufacturers are needing the money, something must happen. He compared the present business conditions to a log jam and stated that in all probabilities a crash is imminent, but that the majority of businesses which are built upon safe and sane lines will not be hurt. E. O. Shreve, local manager of the General Electric Company, was the last speaker, and emphasized especially that the prosperity of industry is dependent upon the prosperity of the central station, and that the power shortage which existed in California during the past season was not the only power shortage in the country, as some of the eastern central stations are struggling with a power shortage because of lack of money with which to finance extensions. Mr. Shreve finished his

talk by telling of the hopeful outlook for the electric railways at the present time. They are at last being put on a sound basis by the action of the central station commissions which have come to recognize their problems.

Northwest Electrical Service League Discussed at Spokane Meeting

The electrical industry of Spokane and Eastern Washington was well represented at a dinner meeting held at the Spokane Hotel on the evening of December 2, to listen to a discussion of the objects and plans of the Northwestern Electrical Service League. One hundred and twenty-five were present.

Mr. W. E. Coman, vice-president and general manager of the Washington Water Power Company, presided at the meeting, and said that his company was very glad to cooperate in this movement and lend its moral and financial support to the League.

Various phases of the League's program were discussed by:

L. A. Lewis, Washington Water Power Company; R. W. Clark, Puget Sound Power and Light Company, chairman of the Advisory Committee of the League; John V. Strange, Pacific Power and Light Company; J. I. Colwell, Western Electric Company, Seattle; Harry Byrne, North Coast Electric Company, Seattle; A. J. Gladson, contractor-dealer, Yakima; W. M. Meacham, contractor-dealer, Seattle; S. C. Jaggar and J. R. Tomlinson, contractor-dealers, Portland; and A. C. McMicken, Portland Railway, Light and Power Company, Portland.

Future A. I. E. E. Meetings

At its meeting in Philadelphia, October 8, the Meetings and Papers Committee arranged for this season's Institute meetings as follows:

November meeting, Chicago; January meeting, Cleveland; February, Midwinter Convention, New York; March meeting, New York; April meeting, Pittsburgh; May, Annual Meeting, New York; June, Annual Convention, Salt Lake City.

Record Growth of California Industries Association

At a recent meeting of the board of directors of the California Industries Association, President James H. McDonough announced that thirty-one new members had joined the association during the preceding ten days. This was the largest membership gain ever made by the association in a similar period of time. The membership is made up of companies or firms rather than individuals.

San Francisco A. A. of E. Elects New Officers and Visits Pacific Railway Club Meeting

On December 7 the new officers of the San Francisco Chapter of the American Association of Engineers were elected as follows:

President, G. C. Brown, chief mining engineer, California Industrial Accident Commision; treasurer, F. J. Amweg, consulting engineer, San Francisco; secretary, R. E. Dodge, office engineer, San Francisco division, California State Highway Commission; first vice-president, L. D. Howland, sales engineer, C. C. Moore & Co.; second vice-president, W. H. Phelps, assistant division engineer, Southern Pacific Company.

After the business meeting the members adjourned to the Commercial Club where they were the guests of the Pacific Railway Club. A talk on "Track Maintenance" was given by W. H. Kirkbride, engineer of maintenance of way and structures for the Southern Pacific Company, and one on "The Use of Motor Cars in Track Maintenance Work" by Stephen Smith of the Fairbanks-Morse Company. Both talks were illustrated by lantern slides.

Development League Hears Talk on Europe

"Europe Through American Eyes" was the subject presented to the San Francisco Electrical Development League at its regular meeting in the Palace Hotel on November the twenty-ninth, at which time a subscription list for the starving children of Vienna was started. The chairman of the day was Mr. A. H. Halloran, Pacific Coast representative of the McGraw-Hill Book Company, who introduced the speaker of the day, Mr. W. V. Woehlke, secretary-treasurer of the Sunset Publishing Company, telling of his reputation as a careful student of economics.

Mr. Woehlke told of his trip through Europe and spoke particularly of conditions as he found them in the Central Empire. Europe has urgent need of all our surplus products, Mr. Woehlke stated, but due to the war time conditions still existing there and the present rate of exchange Europe cannot afford to pay the premium which the United States demands for its excess material. Mr. Woehlke stated that in the Central Powers the labor costs are very high, having risen from five hundred to eight hundred per cent, and that the purchasing power of the money in those countries is only one-twelfth of what it was in pre-war days. Consequently, there is from sixteen to thirty-five per cent reduction in consumption. Bolshevism does not interest the laboring man of Europe at the present time. He only wants to work and get back to the 1914 standard of living. Mr. Woehlke said that the infant mortality in Vienna is two hundred and seventy-four out of every thousand for children under five years of age, or nineteen times greater than that of New York City. He finished his speech by stating that the people of Europe have faith in the power of the United States to clean up all the petty jealousies that exist there and to determine the correct boundaries and relations between European countries, and that what we need at this time is a foreign policy with a backbone.

At the conclusion of Mr. Woehlke's talk H. F. Jackson, general manager of the Great Western Power Company, announced that he wanted to start a subscription list for the starving children of Vienna and that all the money so raised be sent to the Hoover Food Commission from the San Francisco Electrical Development League. Inside of seven minutes over $1,000 was raised and the San Francisco Electrical Development League is conducting a campaign, hoping to swell this amount before sending on the check.

Scientific Advertising Presented to Oregon Association of Electrical Contractors and Dealers

The regular bi-monthly meeting of the first district, Oregon Association of Electrical Contractors and Dealers, was held Monday evening, November 22.

In pursuance with the association's new policy of having one of its members present a paper at each of the meetings, Mr. C. P. Scott, of the Scott Electric Company, presented a very interesting and instructive paper on "Scientific Advertising."

Plans were laid to run three pages of cooperative Christmas advertising in one of the local papers between now and Christmas, to better sell the public on the electrical Christmas idea and to induce them to patronize the electrical specialty shop. If this advertising proves successful it is planned to carry it on during the year 1921.

COMING CONVENTIONS

CALIFORNIA ASSOCIATION ELECTRICAL CONTRACTORS AND DEALERS
Quarterly Meeting—Stockton, Cal., Jan 22, 1921

PACIFIC COAST SECTION, NATIONAL ELECTRIC LIGHT ASSOCIATION
Annual Convention—Del Monte, California, May 25-27, 1921

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Annual Convention—Salt Lake City, Utah, June 20-26, 1921

DO YOU REMEMBER

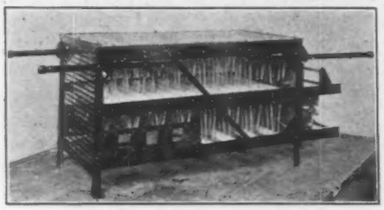
—in 1896 when electric cars were first run out to the beach in San Francisco, supplanting the steam line?

LATEST IN EVERYTHING ELECTRICAL

(The ever increasing popularity of electric welding in Western states makes the announcement of a new portable welding outfit, which appears on this page, especially significant. The industrial engineer will be interested in the new line of controllers announced here and also in the new battery charger. A new ironer and a portable motor are presented for the benefit of the electrical dealer.—The Editor.)

PORTABLE WELDING OUTFIT

The General Electric Company has developed an electric arc welding equipment which is said to be especially



The new portable outfit for electric welding

adapted to welding rail bonds on street or industrial railways.

The apparatus consists of a wire resistance unit, mounted in a light metal frame, with suitable leads for connecting to the power supply circuits and to the electrode holder. Switches provide a welding current with range of from 60 to 200 amperes, in 15-amp. steps.

The circuit is controlled through a contactor, operated by means of a push-button switch located close to the electrode holder.

NEW BATTERY CHARGER

The Valley Electric Company is placing a new device, the Type M S Rectifier, on the market, believing that it will answer the demand for a simple and dependable charging system which

Principal parts of the M S Rectifier. Diagram of the workings of the device.

has been created by the increasing use of electrical signal systems.

The base contains a small transformer with a set of taps for difierent voltage batteries. The transformer is designed for low iron losses and built of the best silicon transformer sheet steel. The complete transformer is soaked in a baking varnish and baked so as to be water-proof.

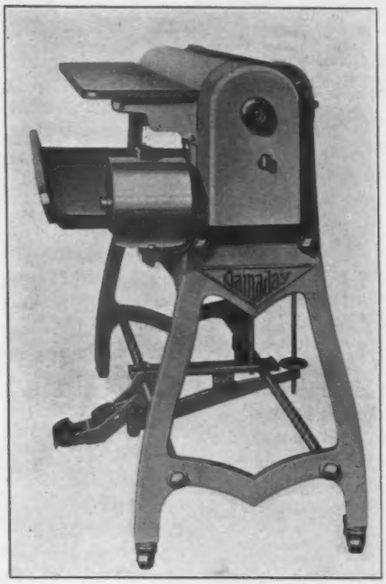
The rectifying movement proper is mounted on a slate base and has two rows of binding posts, one set of which connects to the transformer and the other set to the battery terminals.

NEW POWER IRONER

The Gainaday Ironer, being placed on the market by the Pittsburgh Gage & Supply Company, Pittsburgh, Pa, is electrically operated and heats by gas.

It is made in 42-in., 46-in. and 50-in. roll widths, is direct motor-driven and foot-controlled, and can be operated while sitting down. The gear mechanism is completely enclosed.

The manufacturer states that the motor carries a strong load, and is located



The new Gainaday Ironer

on the side, within easy reach of the operator. Also that an especial advantage of the ironer is its center gas-feed which automatically distributes an even heat over the whole ironing shoe.

RENEWABLE PLUG FUSE

The Pierce Fuse Corporation of Buffalo, N. Y., announce their new renewable plug fuse as being exceedingly simple and easy to renew. It consists of three parts—a porcelain core, a porcelain case with the brass plug-shell attached, and the link of which the brass plug-end contact disc is a part.

To renew the Pierce plug fuse, it is necessary only to unscrew the core from the case, pull out the blown link, slip in a refill and screw back the case. Contact is made by bending the link over so that as the plug is put together, the link is engaged between the core and the brass shell of the case and held tight.

REGULATOR FOR CONTROLLING LINE VOLTAGE

The American Galco, Inc., Grand Central Place, New York, has developed a new device for regulating the line voltage, motor-starting current, arc furnace current, and so forth. The action is controlled by the varying pressure in a stream of water constantly flowing through a pipe.

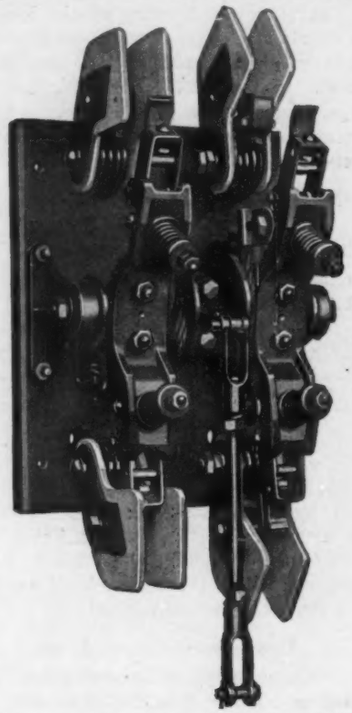
NEW ELECTRIC RIVET HEATER

The electric rivet heater which is being placed on the market by the Taylor Welder Company, Warren, Ohio, is built in sizes to heat two rivets at a time. The equipment consists of a 15-kw. transformer and a five-step self-contained regulator for controlling heat and rivet adjustment. The complete outfit weighs about 400 lb., occupies 31 in. by 18-in. space and is 40 in. high.

A NEW CLAPPER-TYPE CONTROLLER

The Allen-Bradley Company of Milwaukee, Wisconsin, announce a new line of mill, crane and hoist controllers. This controller, made in sizes ranging from 1 hp. to 150 hp., is known as the "clapper-type controller," primarily because all switching and contact-making is done with a clapper-switch contactor.

The manufacturers state that the controller is simplified by the use of the Allen-Bradley graphite compression resistor, mounted within the controller, so



Clapper contactor unit for controllers ranging from twenty to ninety horsepower

as to avoid the use of grids or wire-wound resistors and the need of step contacts.

UTILITY MOTOR MOUNTED ON TRIPOD BASE

For use on farms and other places supplied with 32-volt energy, the Westinghouse Electric & Manufacturing Co., East Pittsburgh, has just placed on the market a ¼-hp. electric power stand.

The portable motor which makes it possible to obtain power as well as light from the farm lighting plant.

The ¼-hp., 32-volt motor is mounted on a substantial tripod base. A telescopic rod is provided to brace the motor and to obtain the proper tension for the belt. The rod is secured on one end through convenient holes provided in the base and the motor frame.

The main shaft speed is 2100 r.p.m. and the back geared shaft turns at 250 r.p.m. There are two pulleys on each shaft, a 6⅝-in. flat pulley and a 2¾-in. grooved pulley being permanently attached to the slow speed shaft. Grindstone, feed cutter, root cutter, water pump, horse clippers, farming mill, clothes washer, cream separator, butter churn, sausage grinder, and ice cream freezer are among the devices which can be run by this motor.

NEW LIGHTING DEVICES

A number of new devices have just been placed on the market by Harvey Hubbell, Inc., of Bridgeport, Conn.

On the right is a new surface switch, in the center is a new type attachment plug, while to the left is a pull socket with luminous acorn.

Among them is the new Toggle Surface Switch which is manipulated by the throwing of a lever rather than by the turning of a key or button. The manufacturer states that this surface switch allows the switch to be made more attractive and stronger than the ordinary one, that manipulation is more convenient and that the switch is self-indicating.

The so-called Composition Attachment Plug with a bayonet base is designed for 6 amperes—250 volts. The Luminous Acorn attached to various pull devices is also being presented.

Books and Bulletins

The Holophane Datalog

A complete engineering handbook on illumination as well as a catalog of products has been recently published by the Holophane Glass Company, Inc., New York, under the name of the Holophane Datalog.

Publication on Illumination

The illumination engineer will be interested in Scientific Paper No. 391 of the Bureau of Standards entitled "The Measurement of Disuse Reflection Factors, and A New Absolute Reflectometer."

Report of Smithsonian Institution

The annual report of the Board of Regents of the Smithsonian Institution for the year 1918 has recently been published. This shows the operation, expenditures and condition of the institution for the year ending June 30, 1918.

Bureau of Mines

The third of a series of yearly petroleum bibliographies has recently been published by the Bureau of Mines. The two preceding, Bulletin 149 and Bulletin 165, were for the years 1915 and 1916. This Bulletin 180, by E. H. Burroughs, is for 1917.

Insulated Wire Cable Handbook

The Okonite Company has published a book which is a complete handbook on its extensive line of insulated wire and cable. All the parts of the factory as well as the various types of wire and cable are shown in the numerous illustrations.

Hydroelectric Companies

The October 30 issue of "The Magazine of Wall Street" contains an interesting article under the above title pointing out some of the advantages of water power companies and their vast future possibilities. In the article, two companies whose power resources are largely hydro are reviewed.

Making Panel Board History

An interesting folder under this title is being distributed by the Benjamin Electric Manufacturing Co. in connection with their publicity campaign on the Benjamin-Starrett Panel Board line. Complete illustrations and descriptions of the various types and sizes are attractively given.

Fort Wayne Electric Rock Drill

The Rock Drill Department of the General Electric Company at Fort Wayne, Indiana, has published an unusually attractive booklet which presents the structure and usage of the Type "A" drill which has been successfully used in large mines, railroad tunnels and in quarries.

Fan Booklet for the Dealer

The Robbins & Myers Company of Springfield, Ohio, is distributing a booklet entitled "Putting Your Fans on the Profit Side of the Counter" and the electrical dealer is told how to do so. Four leaflets designed for local distribution are included with directions for ordering same. A number of examples of the newspaper advertising which the manufacturer will supply are also given.

Bureau of Standards

Quantitative data on the color and spectral distribution of energy of some modern searchlight arcs and spectroscopic analysis of the carbons is given in the late publication of the Bureau of Standards, Technologic Paper No. 108, under the title: "Color and Spectral Composition of Certain High-Intensity Searchlight Arcs." Methods of measurement are also described herein.

Booklet on Cleaners and Vibrators

"Royal Breezes" is the title of a new monthly dealer-help booklet edited by Frank B. Rae, Jr. for the P. A. Geier Company of Cleveland, in the interests of jobbers, dealers and salesmen who handle Royal cleaners and vibrators.

The November issue contains an especially interesting article on the various types of rugs and instructions regarding their cleaning and care.

Modern Ways for Modern Days

The most frivolous bride will read the story of the electrical appliance as

The new Westinghouse Booklet

it is told in the latest Westinghouse Electric & Manufacturing Co. booklet. Only seven tiny lines appear on each page accompanying an artistic picture of the appliance and finished off with a sketch of the appliance in use.

Electric Drive for Cotton Openers and Pickers

The Westinghouse Electric & Manufacturing Company has issued Leaflet 1910 which describes and illustrates "Electric Drive for Cotton Openers and Pickers." The different methods of drive are given with a table for calculating the size of motor for group drive. Motors and starting apparatus for this equipment are also described and illustrated.

Electric Heating of Air

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., have recently published a leaflet for the purpose of describing the Convector type Electric Air Heaters. The leaflet also tells briefly the advantages of electric heat over other forms of heating and gives thumb rules which enable the customer to closely estimate the number or size of meters required for any particular installation.

"Do-It-Electrically" Bulletin

A recent publication of the Philadelphia Electric Company sets forth in a most attractive manner the joy and practicability of "doing it all electrically." The several chapters are: Electrifying Housework's Biggest Job—Dishwashing; Electric Bread; Homemaking, a New-Old Profession; Cold; A Bolshevik Motor?; and Make Your Electric Fan Work for You.

NEW ELECTRICAL DEVELOPMENTS

(Announcements of new projects which involve the development of considerable hydroelectric power are made in the Northwest. Power companies of the Central District are constructing new substations and planning various other system enlargements. Interesting Commission rulings are reported from both the Southwest and Intermountain regions.—The Editor.)

THE PACIFIC NORTHWEST

SAMS VALLEY, ORE.—The Sams Valley Power Company has been incorporated here, with Metla Pelton, president. The company will distribute electric energy.

ALBANY, ORE.—A new industry for Albany has been announced by the M. C. Morgan Manufacturing Company, who plan to manufacture food flavoring, washing powders, polishes, cleaners and similar household materials.

ILWACO, WASH.—This city is considering the purchase of the distribution system of the North Shore Light & Power Company, and the installation of a 1,000-kw. generating plant. If an agreement can be reached, the lines will be taken over immediately.

SEATTLE, WASH.—Plans and specifications for the architectural work in connection with the construction of the 10-story main building of the Pacific Telephone & Telegraph Company have been completed. The value of the work has been placed at $950,000.

HOQUIAM, WASH.—The city council has rejected the only bid submitted for installation and maintenance of a boulevard lighting system for the business section of the city. The Grays Harbor Railway & Light Company submitted the bid. New bids will be called at once.

YAKIMA, WASH.—The Pacific Power & Light Company is spending $75,000 this fall in improvements on its substations and transmission lines to increase its facilities to meet the very urgent demand for increased service in the Yakima Valley territory served by the company.

SALEM, ORE.—The Mount Reuben Mining Company of Grants Pass has made application to the state engineer for the appropriation of water from Reuben Creek in Josephine county for the development of 87 hp., to be used for power purposes in connection with a mining project.

SEATTLE, WASH.—Work on the $9,000,000 Skagit hydroelectric power development has been reduced about 75 per cent and may be forced to suspend entirely next month unless money is obtained by the city to continue its operations. Several millions in bonds remain available, but are useless until they are sold.

SEATTLE, WASH.—The Pacific Coal Company, Smith Building, has presented to the county commissioners of King county a petition for a franchise to construct and maintain a power line to carry 13,000 volts from the Hyde Mine to beyond the town of Black Diamond. Hearing was set for December 13.

SEATTLE, WASH.—Mayor Hugh M. Caldwell and the city council are seeking the assistance and cooperation of Seattle bankers and bond men in marketing the Skagit River power bonds, to enable the continuation of work in the upper Skagit Valley, and to furnish between $2,000,000 and $3,000,000 for work next year.

BEND, ORE.—Ground has been broken for the erection of a new telephone exchange for the Pacific Telephone & Telegraph Company, which will house a five-section board at present, with capacity for the ultimate installation of a ten-section board which will take care of the needs of a city of 12,000 population.

SPOKANE, WASH.—The $200,000 addition to the plant of the Inland Empire Paper Company at Millwood, the construction of which has been in progress since spring, will be completed about December 1, it has been announced by Stanley G. Rosebush, president of the company. A 1200-hp. synchronous motor to drive additional grinders will be installed.

SILVERTON, ORE.—Erection of a pulp mill to be operated in connection with the lumber plants of the Silver Falls Timber Company at Silverton, has been announced. By-products of the sawmills of the Silverton company will be ground at pulp plant and shipped to the various paper mills of the Pacific Northwest to be converted into the finished product.

PORTLAND, ORE.—The Clackamas Power & Irrigation Company of Portland has filed an application for a permit to appropriate 1,000 second-feet of water from Clackamas river, from which 11,705 horsepower will be developed by a hydroelectric generating plant. The total cost of the project is estimated at $1,250,000, construction work to be started within one year from grant of permit.

KLAMATH, ORE.—Senator Chamberlain and Representative Sinnott of Oregon appeared before Secretary Payne Dec. 2 as representatives of the water users of the Klamath (Ore.) reclamation project to ask cancellation of the contract with the California and Oregon Power Company for construction of a dam at the head of Klamath Lake, free of cost to the government. Failing cancellation, they recommended various amendments, calculated to protect the water users.

MARSHFIELD, ORE.—In line with a movement for a larger capacity power and electric plant at Bandon, with a dam on Willow Creek, in Curry county, and a transmission line 20 miles to Bandon, the Bandon Power Company has submitted to the city council a price of $35,000 for its plant, including buildings, distribution system and all machinery. Engineers had estimated the probable cost of the new system at $105,000, including the Bandon Power Company's holdings at a price of $25,000.

SPOKANE, WASH.—Interest was revived recently in the huge hydroelectric project proposed at Lake Chelan by the Great Northern Railroad. The dam when constructed will raise the lake 12 feet and furnish a steady head of water for a generating plant capable of supplying an area of 200 miles with electric current. For immediate relief in the electrical and water supply for the city of Chelan, the company will enlarge the city water-mains and put in a new gasoline auxiliary engine at a cost of $25,000.

KLAMATH FALLS.—The main point of the findings of the special committee of the Chamber of Commerce, which has been conducting the hearing in the dispute of the American Legion and the California-Oregon Power Company on the Upper Klamath Lake storage question, is that the California-Oregon Power Company is acting merely as an agent of the United States Government and has not acquired, under its 1917 contract for building the Link River Dam, any rights to the waters of the Upper Klamath Lake or its tributaries.

STAVE FALLS, B. C.—It is reported that the Western Canada Power Company plans to raise the present level of the storage dam at Stave Falls, by another fifteen feet, to meet increasing demands for the generation of electric current. The additional water storage thus created would allow of the installation of another electrical unit in the company's power house of at least 13,000 horsepower capacity. It is roughly estimated that the additions to the power plant will cost $200,000.

THE PACIFIC CENTRAL DISTRICT

OAKLAND, CAL.—By December 15 the School Department will have under construction or will have contracted for $450,000 worth of new schools under the $5,000,000 building program, according to the chief of construction.

REDDING, CAL.—The Pacific Gas and Electric company has enlarged the Shasta Power district to include all of Shasta county and the northern portion of Tehama county and placed G. R. Milford in charge.

RICHMOND, CAL.—The Santa Fe foundry is manufacturing 700-pound projectiles on a contract from the War Department. As fast as the projectiles are manufactured they are being shipped to government loading stations.

COLOMA, CAL.—Two more of the thirty local farmers are installing more motor power on the farms. Homer Metcalfe of Coloma and Frank Wagner of Lotus have placed orders for power spray pumps for their orchards.

DOWNIEVILLE, CAL.—Thomas and Leo Bessler are preparing to build a five-stamp quartz mill on their property in Downieville. A fall of something like 90 feet can be obtained, which will be ample for all the water power needed.

CHICO, CAL.—The new Sperry rice mill at Chico began operating November 22 and will have an output of 2400 sacks or six carloads of finished rice daily during the season. The mill represents an investment of $300,000 by the Sperry Flour Company.

REDDING, CAL.—The Pit River Power Company has made an application to the Federal Water Commission in Washington for a preliminary permit for power development on Pit river above Copper City. The Commission has fixed February 10 as the time for hearing.

FRESNO, CAL.—The San Joaquin Light and Power company will begin at once the erection of a power sub-station to cost $15,000 on the James ranch colony, owned by Los Angeles and San Francisco capitalists, and on which has just been completed 50 miles of power lines.

RICHMOND, CAL.—Electroliers and lighting of Macdonald, Richmond and Washington avenues was discussed at a meeting of the council recently and it was voted to accept the contract of the Western States Gas & Electric Company, which will install the system under a ten-year contract.

WATSONVILLE, CAL.—According to communications received by Secretary E. C. Learock of the local chamber of commerce, the Granite Springs Estate company has under consideration the erection of a large dehydration plant in this city. It is said the company's assets are over $1,800,000.

GRASS VALLEY, CAL.—The Pacific Gas and Electric Company has a large crew of men employed in the southeastern part of this county, increasing the capacity of the Drum power line, the medium for transporting electric energy to Sacramento and the Bay region. Three additional high power wires are being strung the entire length of the line.

LODI, CAL.—The annual report of the city clerk for the fiscal year ending June 30, 1920, shows the receipts from the municipal electric plant amounting to $52,169.30, and the expense as $32,100.31, leaving a profit of $20,068.99. Out of this was paid $1,925.33 on the bonds and $8,367.56 in improving the plant. During the

year there has been an increase of 255 users of electricity.

SONORA, CAL.—Involving a $2,000,000 power plant project, application for use of part of the natural flow of the Stanislaus river has been filed with the recorder of Tuolumne county. Application is made by Frank R. Pattee of Oakland and Samuel Bernhard of San Francisco, who contemplate the erection of a power plant at the headwaters of the river to develop about 9600 horsepower

SAN JOAQUIN, CAL.—The San Joaquin Valley Farm Lands Company is extending their transmission lines to 22 miles. This will make a total of approximately 60 miles of transmission lines constructed on the James Ranch within the last year. These lines are soon to be taken over by the San Joaquin Light and Power Company which is now constructing a sub-station one mile north of this city.

RICHMOND, CAL.—George E. Sheldon, secretary of the Downtown Association of Oakland, wants Oakland and Richmond to join in installing electroliers. In a communication to the City Council he states that Oakland is about to install electroliers, and if the two cities could agree on the same type an order sufficient for all could be placed with the manufacturers and a great deal of money saved.

SAN FRANCISCO, CAL.—"With two utilities operating in a field the business of which justifies the operation of but one, the public cannot be expected to pay in rates charges that will yield to each utility a return on its investment," says the Railroad Commission in an opinion accompanying an order allowing the Goldberg Motor Boats and the Delta Transportation Company only a 25% increase in charges instead of the 100% and more increase asked for.

SAN FRANCISCO, CAL.—A recent order issued by the Railroad Commission authorizes the Great Western Power Company of California to issue $1,500,000 of its general mortgage convertible 8 per cent gold bonds. Authorization is given the company to use $969,927.38 to reimburse its treasury, the money subsequently to be used to pay in part for plant extensions. The balance of the proceeds of the bond sale is also to be used to defray construction costs.

FRESNO, CAL.—The proposed bond issue for the acquisition of the system of the Fresno Canal and Land Company by the Fresno Irrigation District will be for $2,000,000, under the recommendations submitted to the board of directors by Engineer George L. Swendsen. Of this amount $1,750,000 represents the purchase price of the holdings as agreed upon by the boards of directors of the two organizations, while the remainder is for the purpose of improvements. It is planned to hold the election in the district about January 15.

VALLEJO, CAL.—The annual report of Major General Lansing H. Beach, Chief of Army Engineers at Washington, shows that on July 1st, this year, there was an unexpected balance of the funds for improvement of San Pablo Bay and Mare Island Strait of $394,169, with outstanding liabilities of $18,667. The amount expended during the fiscal year for maintenance was $70,322. With the funds available it is proposed to deepen the channel in San Pablo Bay and Mare Island Strait to a depth of thirty-five feet and a width of 500 feet, and dredge a turning basin on Mare Island Strait.

SACRAMENTO, CAL.—The plan of Government engineers to build four locks in the Sacramento River to raise the water table of the river to allow sufficient water for irrigation purposes in the Sacramento Valley, has recently been discussed in the offices of the Sacramento Valley Development Association. The locks would do away with the necessity of pumping water for irrigation. This, it was said, would save the sum of $200,000 annually among irrigators on the west side of the valley in power alone. A like amount would probably be saved by irrigationists on the east side. The maintenance charge would likewise be saved. The dam proposed by Captain Jarvis would cost approximately $15,000,000. It would permit the reclamation of thousands of acres of salt marshes, which are now practically worthless. The development body plans to interest the Bay section in this project.

THE PACIFIC SOUTHWEST

SAN FERNANDO, CAL.—An arch dam 375 feet high is to be erected in Pacoima Canyon.

PASADENA, CAL.—Work will be started next week on the building of an addition to the Southern Pacific freight depot in this city.

LOS ANGELES, CAL.—The Los Angeles City Council is planning to petition for 5,000 government tents for temporary dwellings to relieve house congestion.

LONG BEACH, CAL.—Negotations looking towards the erection of a modern business block and establishment of a bank at the corner of Broadway and Belmont avenue are in progress between Adam Wasem and a group of Des Moines, Ia., men.

LONG BEACH, CAL.—A four-story brick apartment house to be erected at a cost of $190,000 is one of the latest building projects to be advanced in Long Beach. The site for the new building is on West Seaside boulevard and Neptune Place, near the Virginia Hotel.

PASADENA, CAL.—According to C. W. Koiner, general manager of the city light department, the first unit of a $300,000 addition to the municipal lighting plant will be installed next summer. The proposed site has been purchased from the Pacific Gas & Electric Company, and a new building will be erected to house the enlarged plant.

LOS ANGELES, CAL.—An order issued by the Railroad Commission directs the Pacific Electric Railway Company, operating in various towns in southern California, to reduce practically all of its carload rates, applying on sand, gravel, crushed rock and other such materials, between points on its line. The decreases, which will run from 5 cents to 35 cents per ton, will become effective just as soon as the new tariff can be issued.

LOS ANGELES, CAL.—Ordering a dismissal of the complaint of the trustees of the city of Calipatria, Imperial county, against the Holton Power Company, the Railroad Commission found that the company was following the rules of the Commission in connection with the making of extensions and it must deny the request of the city officials for an order compelling the power company to make service extensions upon more favorable terms than now prevail. The city's request that the utility be compelled to supply certain consumers without payment of extension advance deposits, is denied by the Commission on the ground that such an order would result in discrimination.

THE INTER-MOUNTAIN DISTRICT

FARMINGTON, UTAH.—A new street lighting contract has been signed with the Utah Power & Light Company.

SALT LAKE CITY, UTAH.—Final approval has been given by the city commission of Salt Lake City to plans and specifications for the proposed new whiteway lighting districts.

ROUNDUP, MONT.—To the Inman-Bailey Electric Company of Roundup has been awarded the contract for the installation of an ornamental lighting system in the business and residence districts of Lavina.

LAVINA, MONT.—The city is planning the installation of a municipal lighting system, and C. A. Renshaw, engineer of Roundup, Mont., has been engaged to supervise the work. Wooden poles will be used.

OAKLEY, IDA.—The Idaho Power Company will begin at once the construction of a power line to Vipont. The new power line can be tapped by the three other mines in the Vipont district to supply their needs.

BOULDER, COLO.—Improvements totaling about $60,000 will probably be made in the Boulder street car service if the ordinance passed recently by the city council, increasing the fares, is adopted when it comes up for final hearing early in December.

BOISE, IDA.—The Asequia Mutual Electric Company has been organized, with Robert Carlson, Frank Carlson and L. Keithly, directors. The company will purchase electric energy from the U. S. Reclamation Service, and will serve the needs of its members at cost.

LIVINGSTON, MONT.—Business men of Clyde Park, Wilsall and the valley adjoining are taking steps toward building a line to supply light and power to the Shields Valley. J. R. Kaiserman, Livingston manager of the Montana Power Company, is investigating the situation.

PARK CITY, UTAH.—The power line by which the Utah Power & Light Company is to furnish electric service to the Woodlawn Mining Company, in the Big Cottonwood district, has just been completed, and extensive development work at that property is planned for the immediate future.

BRIGHAM CITY, UTAH.—Work has been done in preparing for the rebuilding of the municipal electric light plant. The dam site in the narrows at Mantua has been located and staked off and about a mile of the pipe line along the mountain side on the north side of the canyon has been surveyed.

FILLMORE, UTAH.—Preliminary plans are under way by the Telluride Power Company to extend its power line from Fillmore through the artesian well belt, on to McCormick and thence to Delta and other West Side towns. There is also some talk of running an electric interurban railway along the power line.

BOISE, IDA.—Articles of incorporation have been filed by The Acequia Mutual Electric Company, a non-profit, cooperative association which was formed in Minidoka county recently. This association has been formed for the purpose of purchasing electric energy from the United States Reclamation Service and distributing it without profit to its members.

HYRUM CITY, UTAH.—According to a decision recently handed down by the Public Utilities Commission of Utah, the Hyrum City municipal electric plant must continue to furnish lighting service to its customers at the present rates, but may increase its rates for industrial power to 3½ cents within the city limits and to 5 cents outside the city limits.

PROVO, UTAH.—Articles of incorporation for the Goshen Valley Irrigation Company, which will irrigate 15,000 acres of land near Goshen, through an electrically operated pumping plant, have recently been filed. It is planned to install the first unit of this plant during the coming summer, which will be able to lift 100 second-feet of water 132 feet above the level of Utah Lake.

MANTI, UTAH.—The city's power plant, which has been undergoing rebuilding and repairs, including the installation of a new Pelton water wheel, has been again placed in operation. The installation of the new wheel has resulted in gained efficiency of 30 per cent, which together with the efficiency gained in the use of a direct drive rather than the old belt drive, and the new and modern machinery, means a total gain of from 75 to 100 per cent in efficiency.

INDEX

The index to Volume 45 of the Journal of Electricity, July-December, 1920, will be ready at the end of the month, and will be mailed to subscribers upon application.

YOU SHOULD BE THANKFUL ——

That only 98 per cent of the population has decided to "do its Christmas shopping early."

That people don't put up umbrellas in the elevator.

That the man in front of you on the street car didn't turn over his newspaper before you finished reading about the murder.

That the person ahead of you stepped on the piece of chewing gum in your path.

That you don't own a farm and have to be always bothering about the weather.

That the Sunday edition of the newspaper comes out only once a week.

That your salary isn't high enough to necessitate your paying income tax.

That you are in no danger of being president for at least four years.

That you don't have to read the Annual Report of anything all the way through.

That it's still safe to cross the street in the suburbs.

That you don't own an automobile and have to worry over the price of gasoline.

That swearing isn't illegal yet, except over the telephone.

That some of your nieces and nephews were born so close to Christmas time that you don't have to buy more than one present.

That you don't have to write this page.

* * *

Building public opinion is supposed to be one of the functions of the press, but occasionally the printed page is a snare and a delusion. Witness the story of the irate man who burst into the editor's office demanding a correction of an item which had appeared.

"If the item was wrong," the editor smoothly replied, "we shall cheerfully do as you request."

"I told one of your reporters I saw a beautiful goldfinch perched on a twig just outside of my bedroom——"

"Well,——"

"And when the item came out in the paper it read 'goldfish.'"

"That isn't so bad."

"Oh, isn't it, though? Well, ever since it was in the paper friends of mine have been hanging around our house thinking I have a private supply of something to drink in my cellar."

Some gems of wisdom for the automobilist are reproduced here from among the replies made by ladies in answer to a list of questions in their examinations for automobile drivers' license:

Q.—If your engine stalls going uphill what do you do?
A.—Try and start it.

Q.—In letting the car stand, which side should be next to the curbing?
A.—The side which is nearest the sidewalk.

Q.—What should you do if the steering gear broke?
A.—Go to the nearest garage and have the man fix it.

Q.—Which has the right of way, a car on a main thoroughfare or a car on a bisecting street, when they approach?
A.—The one that gets there first.

Q.—What is the proper precaution to take when backing your car?
A.—Reverse your engine.

Q.—What is the accelerator?
A.—The name of that something that has something to do with something inside of the car.

Q.—What is the charging indicator?
A.—Your bill for garage, gas and oil.

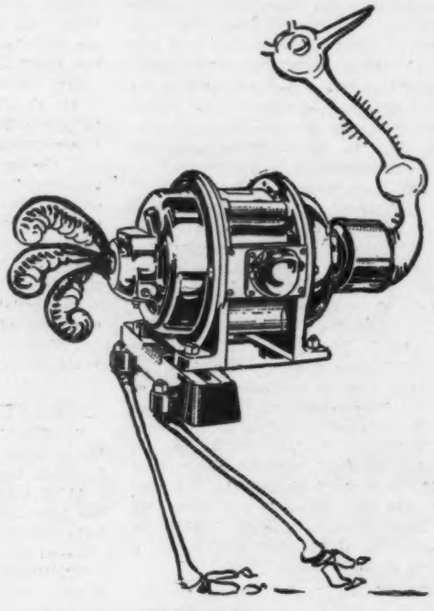
Q.—What is the first rule of the road?
A.—Don't run into anything.

Q.—Where should you have your license number?
A.—On your car.

Q.—What is meant by "short circuit"?
A.—Going around the shortest way.

Q.—When batteries run out, what must you do?
A.—Get them back or get new ones.

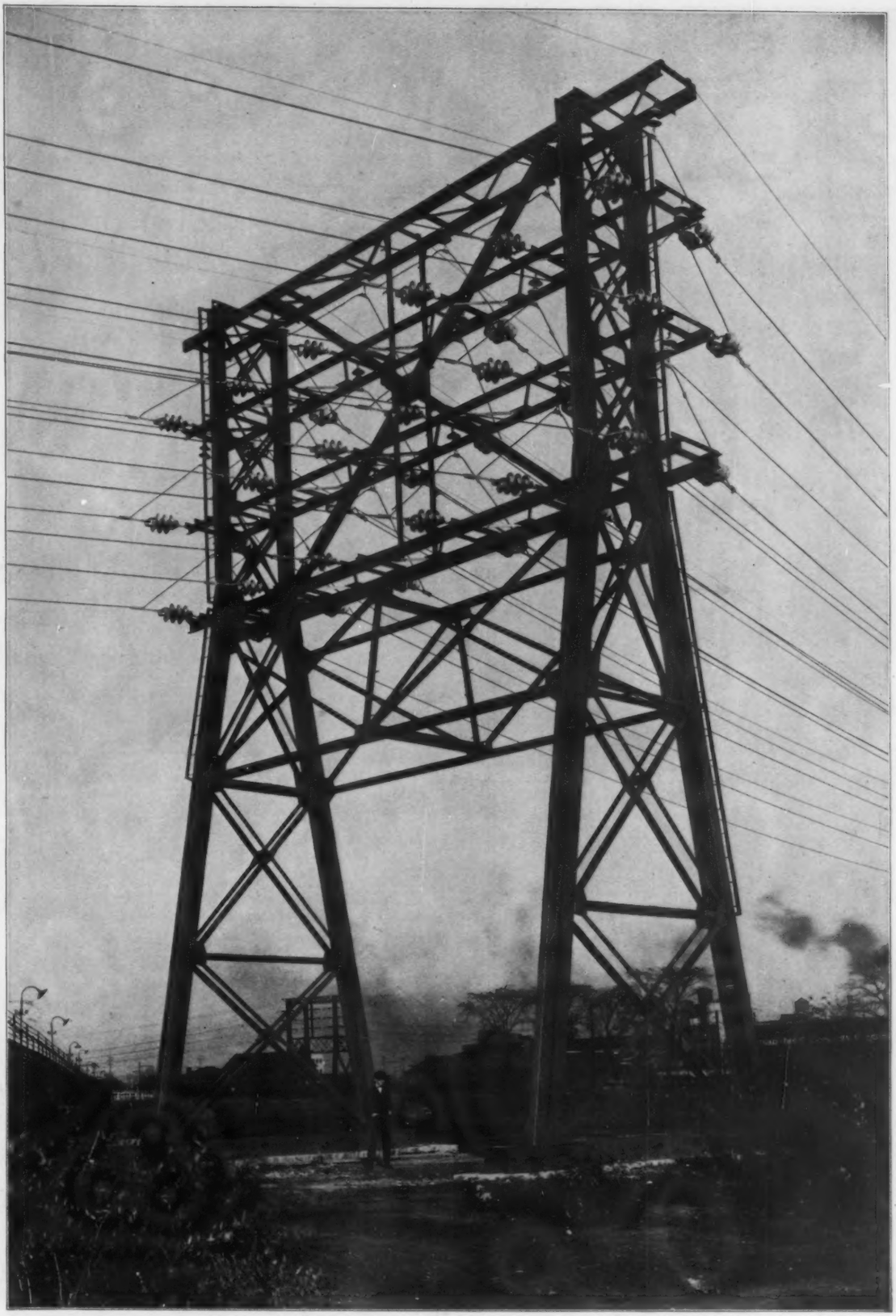
* * *



ELECTRICAL HYBRIDS — III.

The Electric Dynamostrich

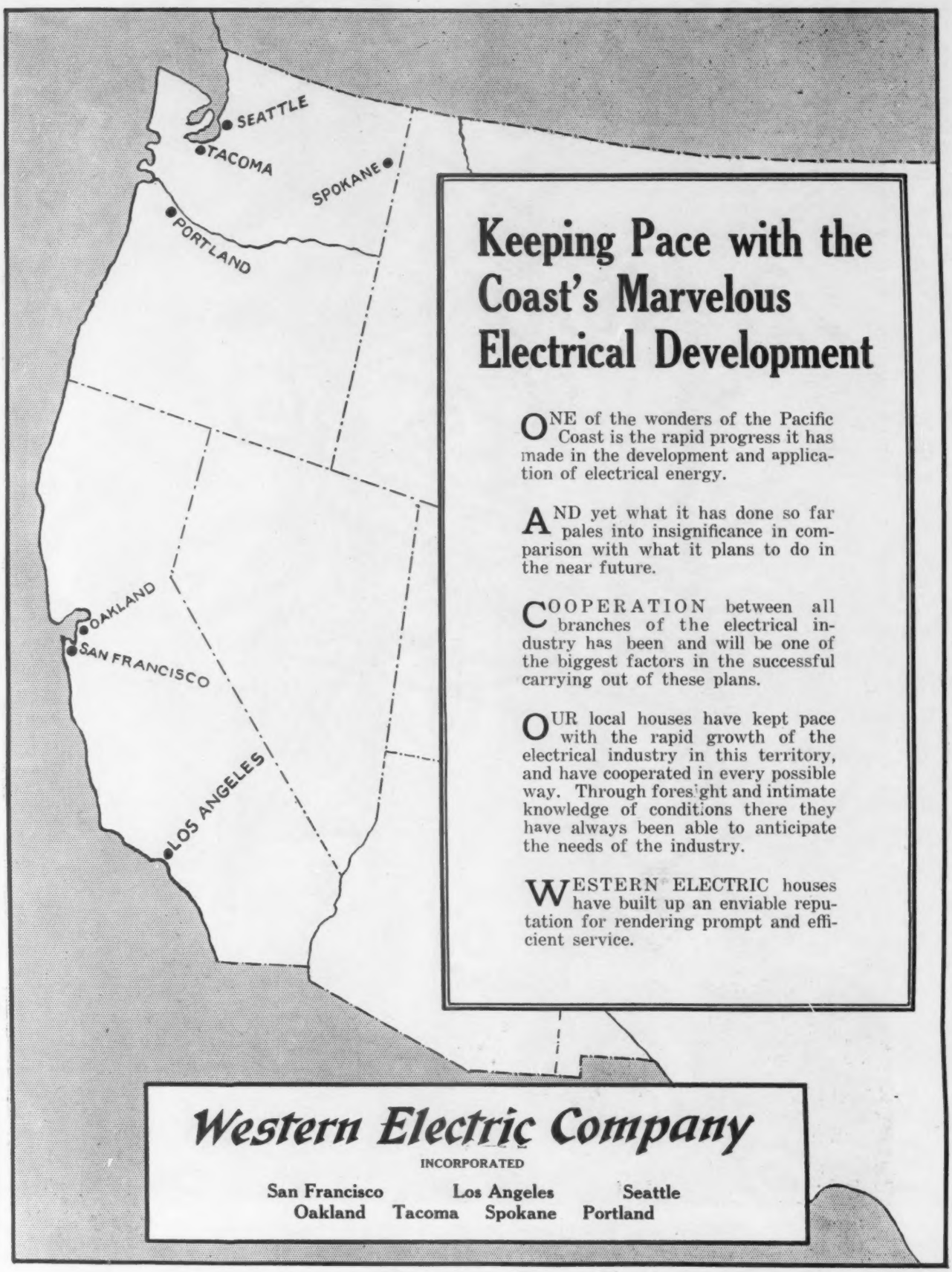
The Electric Dynamostrich is unpleasantly superior,
But yet he is magnetic when excited, it is said;
All motorists and golfers he considers quite inferior —
To boast about their driving when his drive would knock 'em dead.



J-D Insulators Protect World's Largest Power Producer. They Are Rugged Insulators

Pacific Coast Distributers

Baker-Joslyn Company



Keeping Pace with the Coast's Marvelous Electrical Development

ONE of the wonders of the Pacific Coast is the rapid progress it has made in the development and application of electrical energy.

AND yet what it has done so far pales into insignificance in comparison with what it plans to do in the near future.

COOPERATION between all branches of the electrical industry has been and will be one of the biggest factors in the successful carrying out of these plans.

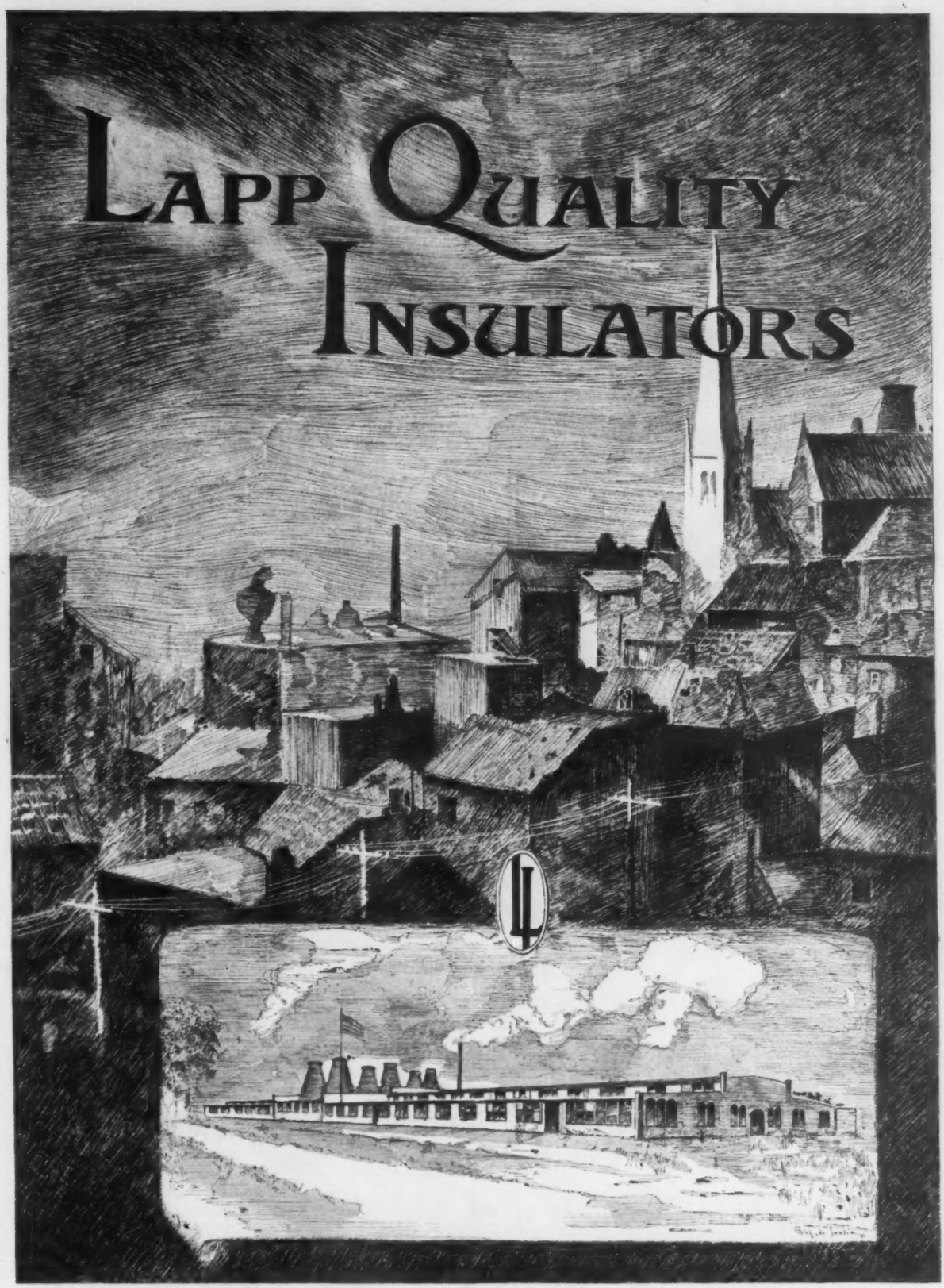
OUR local houses have kept pace with the rapid growth of the electrical industry in this territory, and have cooperated in every possible way. Through foresight and intimate knowledge of conditions there they have always been able to anticipate the needs of the industry.

WESTERN ELECTRIC houses have built up an enviable reputation for rendering prompt and efficient service.

Western Electric Company

INCORPORATED

San Francisco Los Angeles Seattle
Oakland Tacoma Spokane Portland



LAPP INSULATOR CO. INC., LE ROY, N. Y., IS MAILING
NEW CATALOG No. 2. BE SURE TO GET YOUR COPY.

The Fan Season Is Also Hat Cleaning Motor Season

The fan season is also the best season for the sale of hat cleaning motors, and every stock of fans should include a few of these motors. The dealer who has them in stock and who goes after the business finds them a profitable, easy selling item.

Robbins & Myers Hat Cleaning Motors are made for operation on all standard alternating and direct current lighting circuits. They operate at three speeds, controlled by a substantial switch in the base.

The motor is fully enclosed to protect it from dust and moisture. It is mounted on a substantial base and is free from vibration.

Each motor is equipped with eight feet of cord and a separable plug. A chuck can also be supplied with the motor if desired.

Attractive folders will be supplied dealers with their imprint to enable them to circularize prospective customers. Samples sent on request.

THE ROBBINS & MYERS COMPANY

SPRINGFIELD, OHIO

Pacific Coast Office: 701-702 Rialto Bldg., San Francisco

Robbins & Myers Motors

Circle (T) Safety Switches are *Reliable*

When your electrician shows you he is installing "Circle T" Safety Switches you know you are assured of good service.

They are made to give good service.

The accompanying illustration depicts a switchboard of safety switches serving a large industrial plant. Here it is absolutely necessary that the switching operation be performed surely, safely and satisfactorily.

If you appreciate Quality, let us tell you more about our line.

THE TRUMBULL ELECTRIC MFG. CO.

PLAINVILLE, CONN.

New York
Boston

San Francisco, 595 Mission St.

Chicago
Philadelphia

O-B MODERNIZED INSULATORS

On Important French Line

The 100,000 Volt transmission line of the Compagnie Generale d'Electricite runs from Delle to Pouxeux (Vosges), France.

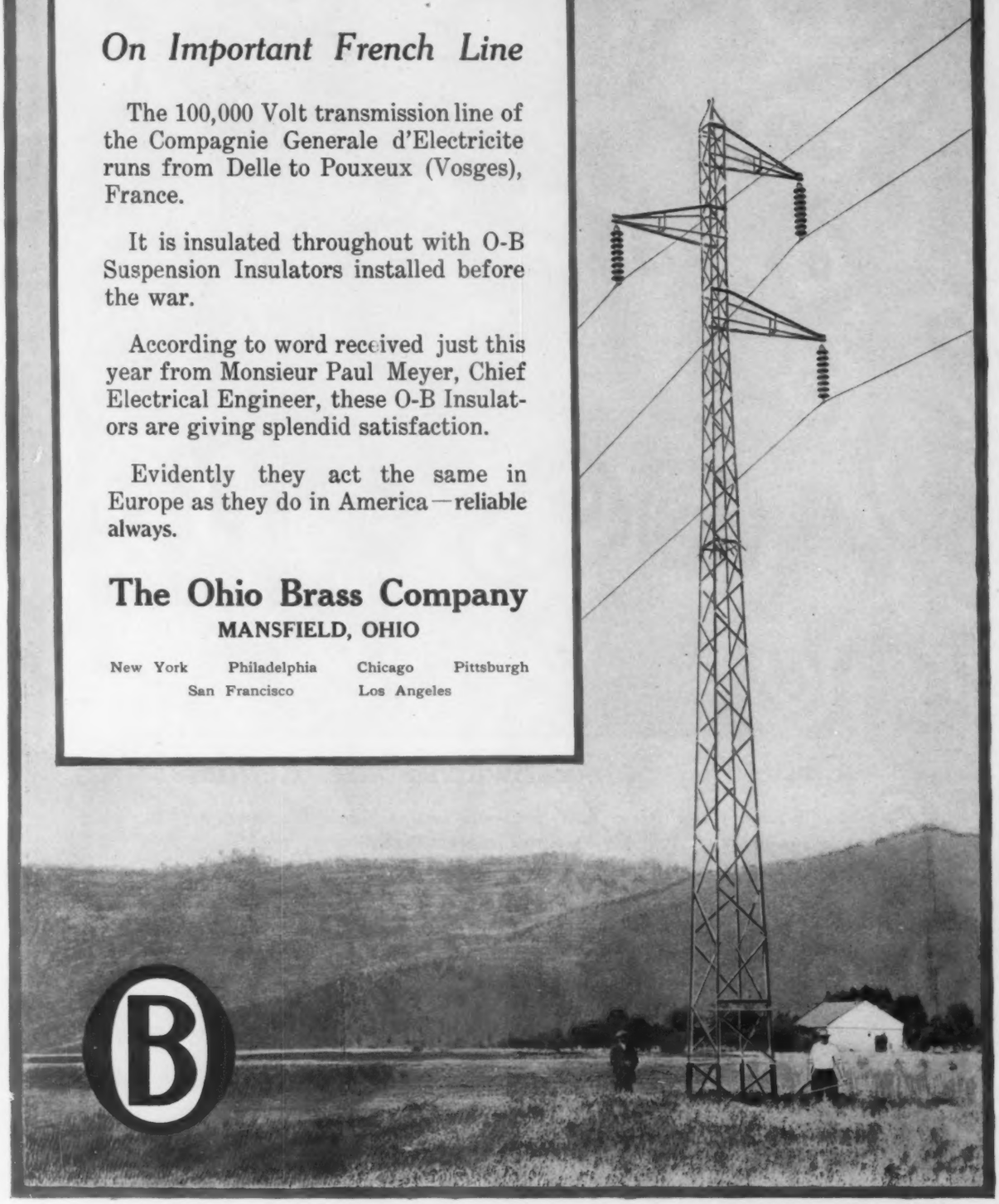
It is insulated throughout with O-B Suspension Insulators installed before the war.

According to word received just this year from Monsieur Paul Meyer, Chief Electrical Engineer, these O-B Insulators are giving splendid satisfaction.

Evidently they act the same in Europe as they do in America—reliable always.

The Ohio Brass Company
MANSFIELD, OHIO

New York Philadelphia Chicago Pittsburgh
San Francisco Los Angeles



ACCURATE

for

Show Window Lighting

National X-Ray Reflector Co.
CHICAGO
New York - San Francisco.

"Federal Electric" 20 Years of Integrity

Supplies—
National Renewable Fuses
Federal Bushings, etc.
Hubbell Receptacles, etc.
G. I. Mazda Lamps
V. V. Fittings
Steel City Outlet Boxes
Matthews' Lamp Guards
Connecticut Cutouts, etc.
Chelten Switches
Duraduct Flexible Conduit
Reliance Time Clocks
Westinghouse Tape
Rubber Covered Wire
Rigid Conduit

Appliances—
Federal Washing Machines
Federal Vacuum Cleaners
Heating Devices
Westinghouse Fans
Federal Lanterns
Dumore Motor Devices

Electric Signs—
Federal Signs—9 styles
Federal Roof Displays
Federal Interior Signs
Reco Flashers and Hoods
Thordarson Sign Transformers

Electric Sirens—
Federal City Fire Siren
Federal Industrial Siren

Scientific Illumination—
Henkel & Best Industrial Lighting Equipment
Hubbell Shades
X-Ray Projectors and Shades

Appearance and Performance

endear the Federal Washing Machine to everywoman's heart

Time tried and tested (10 yrs. in use.)

Easily sold and stays sold.

Marvelous washing principle, 7 to 10 min. per load.

Extra high speed wringer.

All steel frame.

—and these four "helps" make it easy to sell

1. A time payment sales plan of unequaled liberality —no banks—no endorsements.
2. The famous Federal folder, "Make Child's Play of Washing Day."
3. Large Retail Sales Manual.
4. Window Displays, Lantern Slides, Cuts, and Letterheads in profusion.

PLAN A FEDERAL CAMPAIGN NOW!
Being in large production you can get the machines.

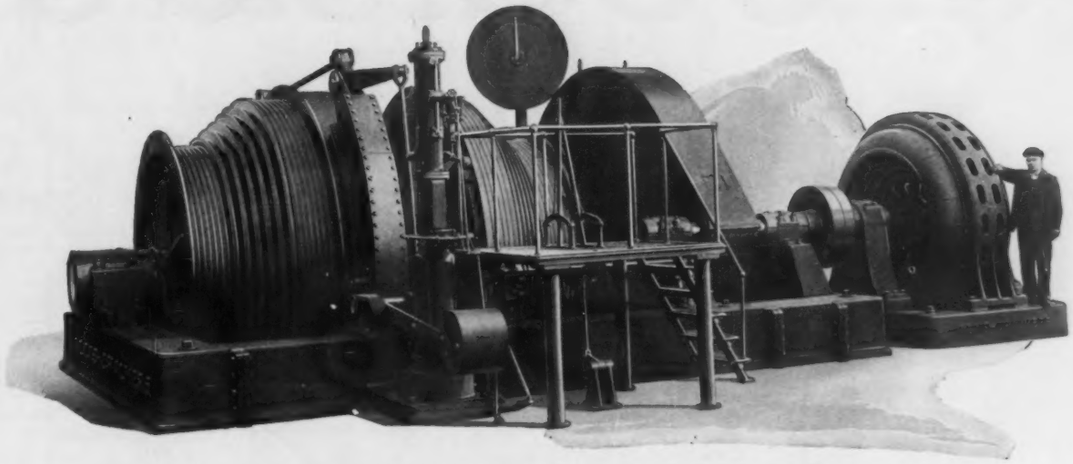
WRITE FOR FULL DETAILS

For the Asking:
1. Federal Electric Supply and Appliance Catalog
2. Federal Electric Sign Catalog

FEDERAL ELECTRIC COMPANY

Manufacturers and Wholesalers
NEW YORK CHICAGO
PORTLAND SAN FRANCISCO SEATTLE
91 New Montgomery St.

ELECTRIC HOISTS



46,000 pounds rope pull, 900 ft. per minute rope speed. Cylindro-conical double drum, single reduction, geared induction, motor driven electric hoist

BUILT FOR STANDARD OIL COMPANY

Note especially these features:

1. Massive design and correct proportions.
2. Power operated structural steel parallel motion post brake.
3. Complete safety features.
4. Continuous base to support all details.
5. Hoist, motor and Liquid Control built by one manufacturer.
6. Complete unit designed for the exact requirements.

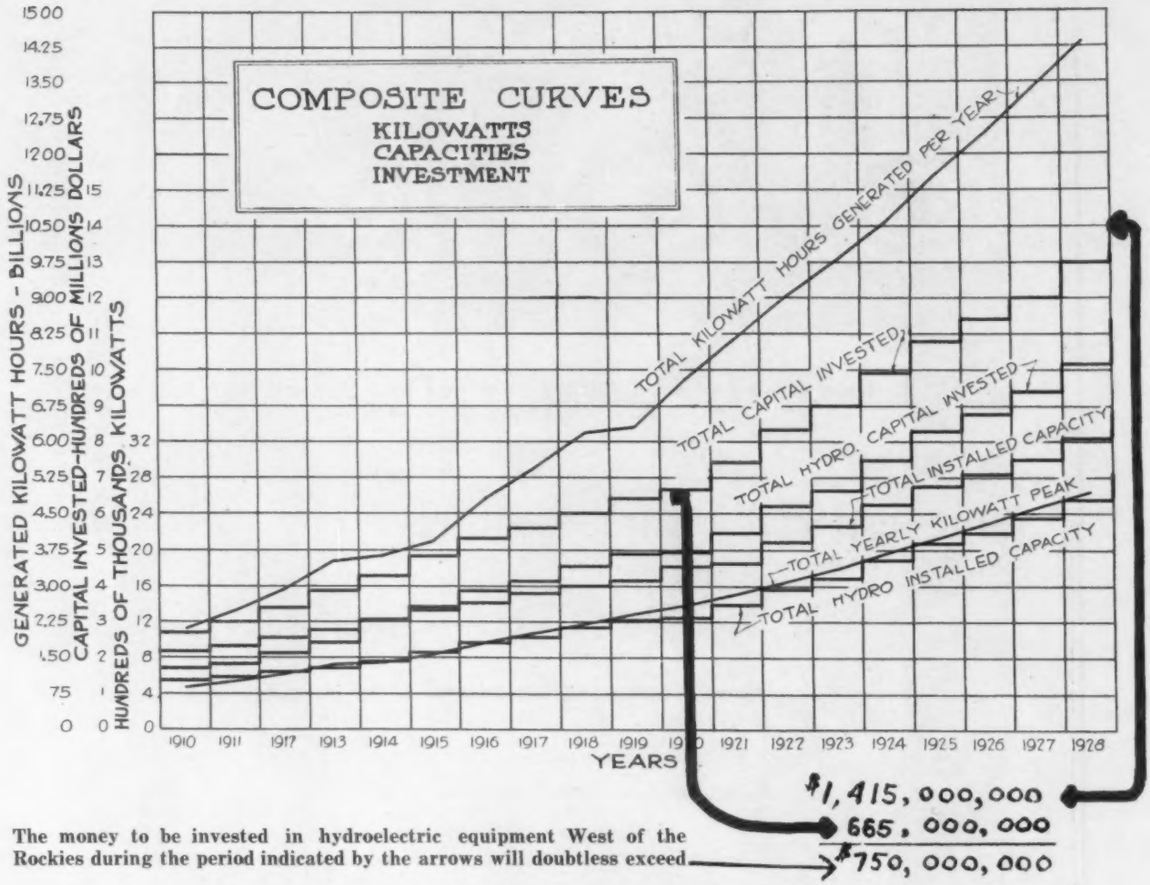
Designed and Built by

Allis-Chalmers Manufacturing Co.

Mining Machinery Dept., Milwaukee, Wis.

Sales Offices in Principal Cities

$1,500,000,0



The money to be invested in hydroelectric equipment West of the Rockies during the period indicated by the arrows will doubtless exceed

The curves shown above are taken from the report submitted to the Pasadena Convention by the Water Power Development Committee of the National Electric Light Association.

THE Water Power Commiitee of the N. E. L. A. shows three-quarters of a billion dollars must be spent west of the Rockies during the next nine years, in development and extension of hydroelectric systems. There is also a rapidly increasing demand for electrical apparatus and supplies from new industrial enterprises.

Mr. Manufacturer, how much of this business do you want as your share? And how do you propose to get in touch with it? The first logical step is, of course, to advertise. It is a matter not only of **reaching the industry** but by telling your story in the correct way, arousing interest in your product.

The Journal of Electricity, in close touch with, and intensively serving the electrical industry in the far West, is recognized as the ideal medium for this purpose.

OO in Nine Years

The Home Electrical Idea, now developing in the West, means three-quarters of a billion dollars more from this section through the sale of electrical supplies and appliances during the next nine years.

Again we say, Mr. Manufacturer, how much of this appliance and supply business do you want?

The Journal of Electricity is at your service in introducing your product to the jobber, the contractor, the dealer, the central station, and through them the populace at large. It reaches practically every jobber, contractor and dealer in the West, and completely covers the central station field. More than 90% of this buying power is reached by our circulation.

The Right Advertising Idea is the one great sales producer

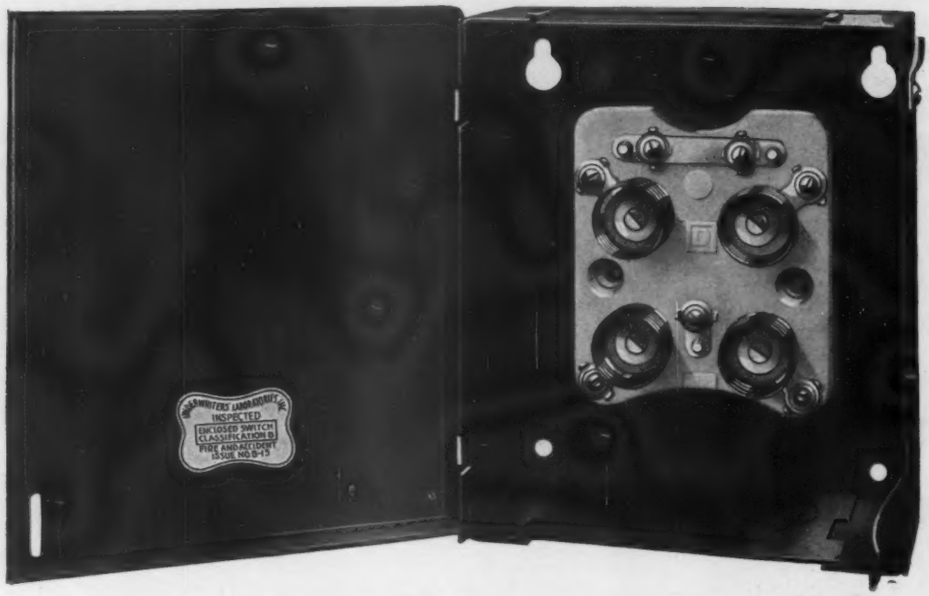
The power of advertising is the power of an idea.

The advertising staff of the Journal of Electricity, thoroughly familiar with the problems and needs of this great West, stands ready at all times to offer effective copy ideas interpreting your advertising in terms of the West. This service is yours for the asking and you should take full advantage of the opportunity.

Herewith is pictured the Electrical Home, located in St. Francis Wood, one of the most beautiful suburbs of San Francisco. It presents a practical demonstration of the use of electrical appliances suitable to the household, and shows the manner in which service outlets should be provided in order that the appliances may be used to the greatest advantage.

This beautiful home was formally opened on June 11, 1920, for public inspection. More than 15,000 persons visited this model exponent of "the home without a servant" during the first two weeks. Similar homes are now under construction in other cities of the West. Let us help you identify yourself with this business-building idea.

ANOTHER BUSINESS GETTER
FOR 1920

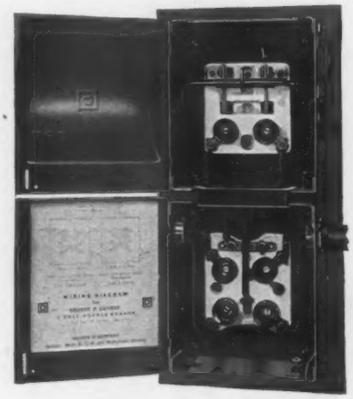


A Square D Enclosed Cut-Out

Just as today finds every Contractor-Dealer studying a new and better way—an easier plan—a more profitable method for wiring and installing electric service in that customer's home, the Square D Company announces their new Enclosed Cut-Out—Number 35211 to solve that problem.

35211 is an answer to the demand for an enclosed cut-out to be used in connection with Square D Service Switches, Numbers 56211, 56311, 96211 and 96311. It is easily connected to Square D Safety Switches. It saves time in mounting by buying cut-outs ready to install, thus eliminating the necessity for carrying a stock of two different types of cut-outs and a stock of metal boxes.

It is designed for all possible service for three to two wire connections, three wire service, two wire distribution; or two to two wire connections, two wire service, two wire distribution.



35211 Connected with 56211

A stock of 35211's will increase the class and volume of your business—and your profit. You will want some of these immediately and to avoid future delays in shipment write us at once and start on a new and profitable line now.

There's a Contractor's Profit In Every Square D Sold

The Square D line includes over 300 types and sizes of steel enclosed, externally-operated switches permitting standardization under practically all conditions.

SQUARE D COMPANY

1400 Rivard Street, Detroit, Michigan

Canadian Factory — Walkerville, Ont., Canada

FRANKLIN
SAFEST POTHEADS

POTHEAD SHADOWS

LET no unsafe pothead cast a black shadow in your plant. Know that on every cable, where the lead sheathing terminates, you are insured against all the voltage surges and abnormal static strains that can occur. You need never fear a break-down.

There is a reason why the Franklin is the safest Pothead. The lead sheath of the cable is clamped and belled out at its end between two brass castings, accurately machined to fit the cable. All static stress is evenly distributed. No costly wiped-sleeve joint is necessary. Any workman in the station can install it.

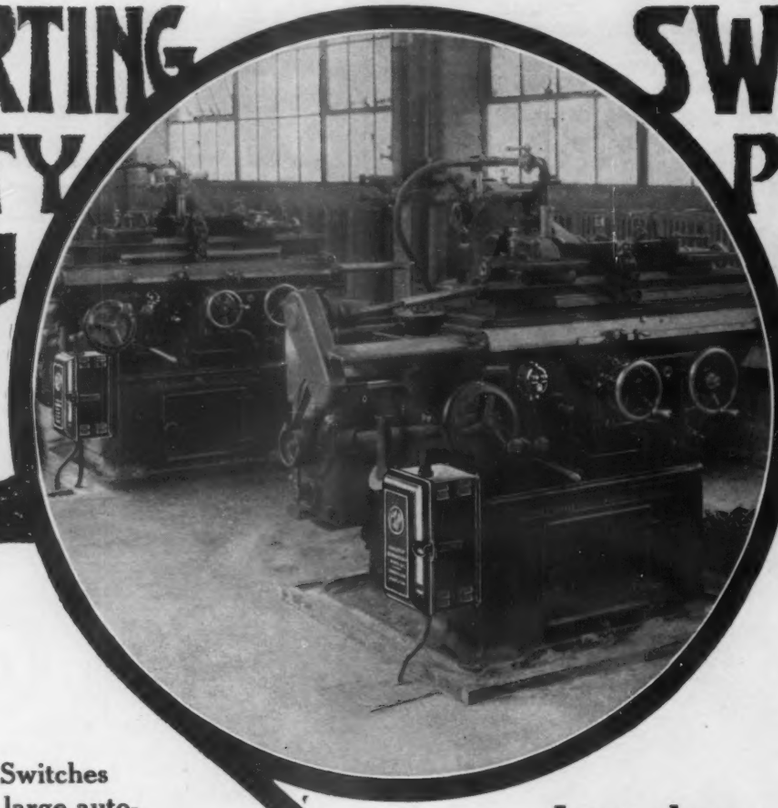
There will be no pothead shadows in your plant.

A "Franklin" Pothead is safe for all time. You can install the "Franklin" and forget it.

Write for data on other "Franklin" Generating Station Equipment

ELECTRICAL DEVELOPMENT & MACHINE COMPANY
Philadelphia
Eastern Sales Agent
UTILITY PRODUCTS CORPORATION
50 Church Street New York City.

STARTING SWITCH TYPE Z B



Z B Starting Switches installed in a large automobile part plant. Note the location of the Push Button. All motors are squirrel cage and less than 5 horse power.

Lost phase protection.
No-voltage protection.
Overload protection.

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND, OHIO

FOR SOUTHERN CALIFORNIA:
O. E. THOMAS,
WASHINGTON BLDG., LOS ANGELES

FOR STATES OF OREGON AND WASHINGTON:
W. MONTELIUS PRICE, SEATTLE, WASH.

FOR NORTHERN CALIFORNIA:
C. F. HENDERSON,
CALL BLDG., SAN FRANCISCO

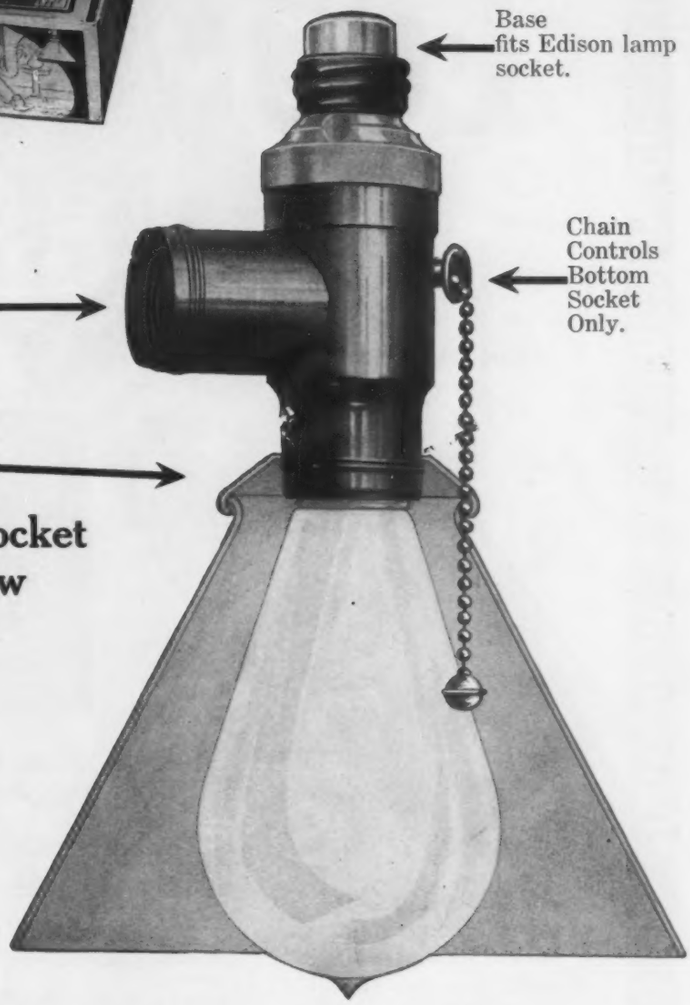
BRYANT Dubl-duty SOCKET

-Dubl-duty Socket-
FITS IN PLACE OF LAMP
MAKES TWO OUTLETS OUT OF ONE
Everybody can use
Anybody can install
THE ONLY DOUBLE EXTENSION SOCKET WITH PULL CHAIN CONTROL
Dubl duty socket
Dubl duty socket

Display carton with two extra individual cartons and cradle for socket, furnished with each standard package of twenty.

Packed in Individual Cartons

Handsome counter display furnished with each standard package of twenty.



Base fits Edison lamp socket.

Chain Controls Bottom Socket Only.

Side socket always on. Fits any Edison screw base device. Carries 660 watts at 250 volts.

Bottom socket takes any Edison screw base device—or a lamp—without changing original position of lamp.

The Pull Chain Extension Socket with Duplex Edison Screw Base Outlets

Retail Selling Price, $1.60 each
Two for $3.00

Slightly higher on Pacific Coast and in Canada

Liberal discount to trade

Ask our nearest office

THE BRYANT ELECTRIC COMPANY

BRIDGEPORT, CONN.

NEW YORK CHICAGO SAN FRANCISCO

ECONOMY FUSES

All Capacities — 0 to 600 amperes in both 250 and 600 volts bear the "Inspected" labels.

—were the first line using an inexpensive bare link for restoring a blown fuse to its original efficiency to be *approved in all capacities* by the Underwriters' Laboratories.

When you order fuses insist on ECONOMY.

For sale by all leading electrical jobbers and dealers.

ECONOMY FUSE & MFG. CO.
CHICAGO, U. S. A.
Economy Fuses also are made in Canada at Montreal

Aladdin Up To Date

Future expansion of the electrical industry depends upon intelligent education of the public in properly wired houses.

The *servantless homes* of five year from now, which are not conveniently wired for the efficient use of electrical appliances will be a drug on the market and the electrical industry will be the sufferer.

Recognition of these facts has resulted in the erection, in San Francisco, of an eight-room house, equipped with 108 outlets, 37 of which are convenient receptacles.

This house has been on public display since June 12 and has attracted thousands of home builders, architects and electrical men.

The Electrical Home, in every sense, is a home, being equipped not only electrically but with every appointment designed to promote home refinement.

Full details concerning the Electrical Home may be obtained from the California Electrical Co-operative Campaign, New Call Building, San Francisco or by addressing our nearest office.

Pacific States Electric Company.

San Francisco Los Angeles Oakland Seattle Portland Spokane

ANACONDA
BARE COPPER WIRE AND CABLE

Has played an extremely important part in the electrification of the Chicago, Milwaukee, and St. Paul Railroad. Nine sizes of copper wire and cable produced in the mills at Great Falls, Montana, having been employed.

No greater compliment could be paid than the fact that it has stood the test in every particular.

"From ore to finished product."

EXCLUSIVE DISTRIBUTORS FOR THE PACIFIC COAST

Pacific States Electric Company.

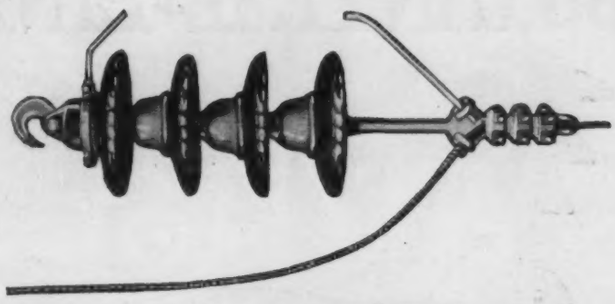
San Francisco Los Angeles Oakland Seattle Portland Spokane

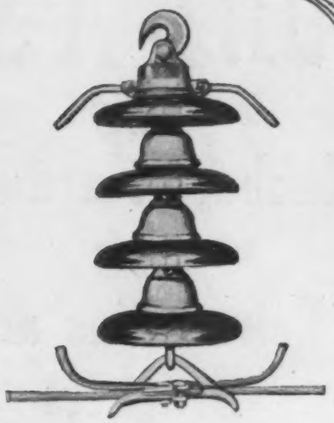
ANACONDA
Copper Mining Co.

Rolling Mills Department

WESTERN SALES OFFICE AND MILL
Great Falls, Montana

GENERAL SALES OFFICE
111 W. WASHINGTON ST.
Chicago, Ill.





Twentieth Century Progress

Illustrated are Victor Arcing Horns used with No. 5800 Victor Insulators, No 2569—A hook and Suspension Clamp No. 4333 for suspension strings.

To the left Victor Arcing Horns used with No. 5800 Victor Insulators, No. 2569—A hook and Victor Strain Clamp No. 3032 for strain strings.

CALLS FOR THE USE OF
VICTOR ARCING HORNS

ARCING Horns are used with suspension insulators for the purpose of limiting the voltage on the line in case of excessive rise and to provide terminals between which arcs may form without damage to the insulators. They are rapidly being adopted by big power companies on the Pacific Coast.

A complete line of Arcing Horns is manufactured by the

LOCKE INSULATOR MFG. CO.
VICTOR, N. Y.

EXCLUSIVE SELLING AGENTS FOR THE PACIFIC COAST

Pacific States Electric Company.

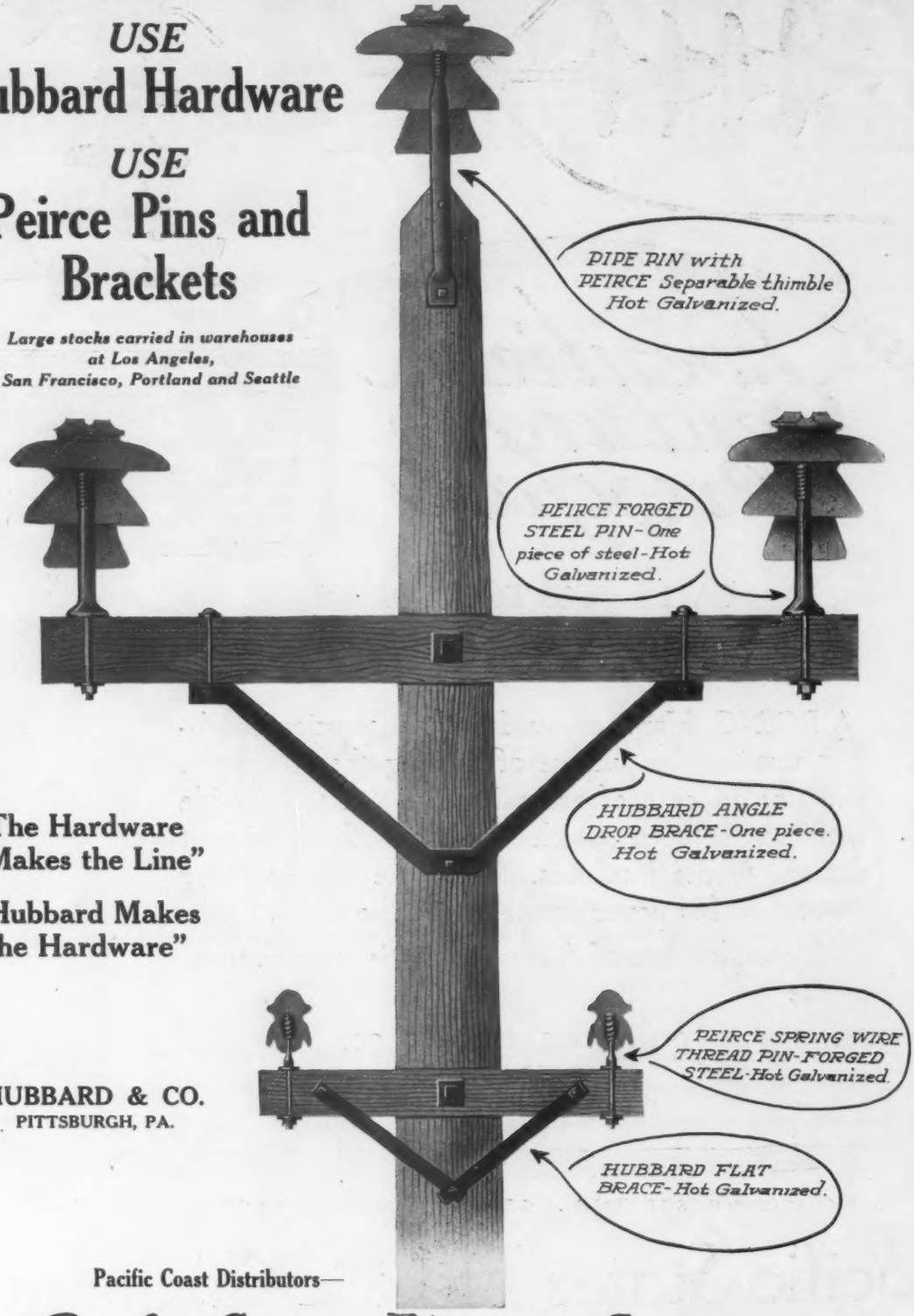
San Francisco Los Angeles Oakland Seattle Portland Spokane

BUILD A SUBSTANTIAL LINE

USE
Hubbard Hardware

USE
Peirce Pins and Brackets

Large stocks carried in warehouses at Los Angeles, San Francisco, Portland and Seattle


PIPE PIN with PEIRCE Separable thimble Hot Galvanized.
PEIRCE FORGED STEEL PIN-One piece of steel-Hot Galvanized.
HUBBARD ANGLE DROP BRACE-One piece. Hot Galvanized.
PEIRCE SPRING WIRE THREAD PIN-FORGED STEEL-Hot Galvanized.
HUBBARD FLAT BRACE-Hot Galvanized.

"The Hardware Makes the Line"

"Hubbard Makes the Hardware"

HUBBARD & CO.
PITTSBURGH, PA.

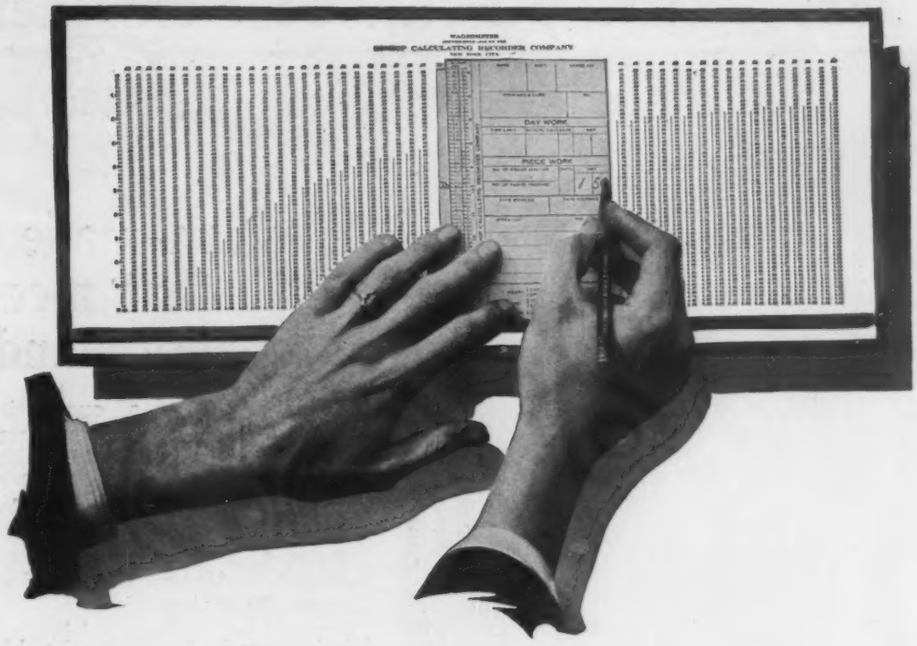
Pacific Coast Distributors—

Pacific States Electric Company.

San Francisco Los Angeles Oakland Seattle Portland Spokane

One Second
to enter the total

Suppose the rate of the worker in question is forty-one cents. The clerk slides the card along the guide until .41 shows at the top and 1.50 in the upper notch. He writes this on the card and the cost record is complete. Four and one-half seconds is a generous allowance for the complete cost card.



"A Simple Twist of the Wrist"

and the answer is before you. An absolute guarantee against clerical errors is afforded by the

BISHOP CALCULATING RECORDER

Eliminate "guess work" on the part of your employees, keep an accurate account of direct costs, indirect labor, piece work, etc., and KNOW that you are in touch with production costs at all times. The BISHOP system not only enables you to accomplish these things but helps you to cope with labor difficulties by reducing the cost details ordinarily required of workmen and reducing the clerical staff.

The Bishop Calculating Recorder

It will take you just one minute to sign, stamp and mail a postal card, and about fifteen minutes to read the book — and for that investment of time we can promise you a lot of valuable cost keeping hints worth while even if you never see a Bishop. Of course, this book discusses the latter too. Mail the card today.

BULLEN & COMPANY

Western Representatives

1508 Claus Spreckels Building
San Francisco, Calif.

Money can't purchase motors finer than "U.S."

Western-made Motors that meet quality standards

The determination of our entire organization has been to build quality motors solely. When we began to make **U. S. MOTORS** back in 1906 we pledged ourselves to build the finest that mechanical ingenuity, scientific ability and conscientious, painstaking workmanship were capable of producing. Our manufacturing accomplishment has made East look to the West for quality motors.

Western-made to meet the highest western standards, **U. S. MOTORS** give admirable service. The nicety of finish which characterizes the workmanship in U. S. motors has inbuilt brutish strength, rugged stamina and enduring performance.

Our literature will interest you. Write for it.

U. S. Electrical Mfg. Co.

General Offices and Factory.
Third and Central
Los Angeles, Cal.

Since 1906

specify U.S. Motors

National Products in California

CALIFORNIA contractors believe in Quality Electrical Work. They use National Products.

The National Line includes "Sherarduct" and "Economy" Rigid Steel Conduits; "Flexsteel" Armored Conductors and Flexible Metallic Conduit; "Flextube" Non-Metallic Flexible Conduit; National Metal Molding, "Liberty" Wire; "National" Outlet Boxes and Covers; Gang Switch Boxes and Covers, Locknuts and Bushings, Fixture Studs and Brackets; "Auto-Steelflex;" "Auto-Brassflex; "Auto-Flextube"—

All you require when you wire

National Metal Molding Co.

General Offices: Pittsburgh

Pacific Coast Representatives:

GARNETT YOUNG & CO.

SAN FRANCISCO
LOS ANGELES
PORTLAND
SEATTLE

The Key to— Central California

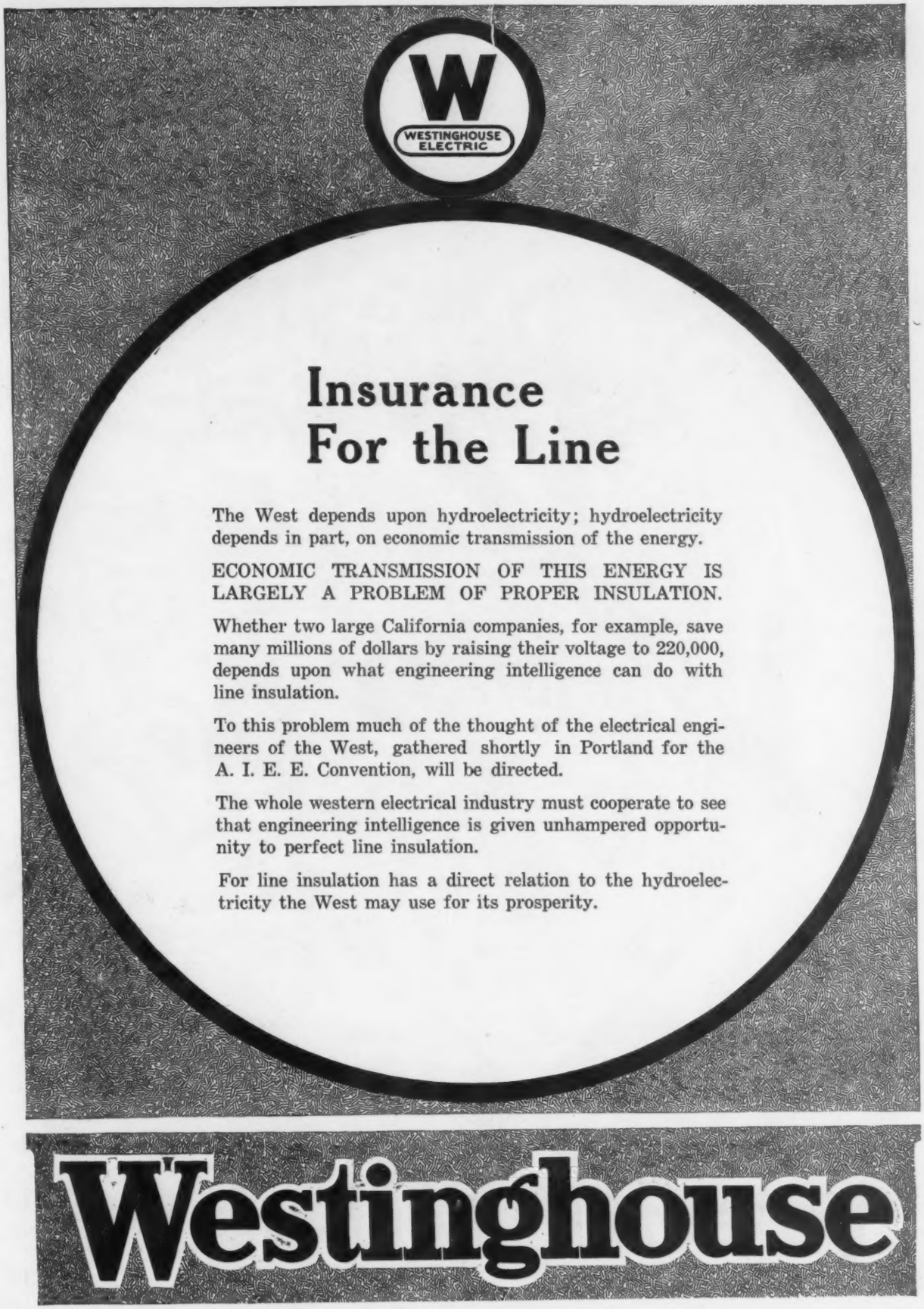
A trading area with a population of more than 1,250,000, including many manufacturing towns and a vast agricultural territory.

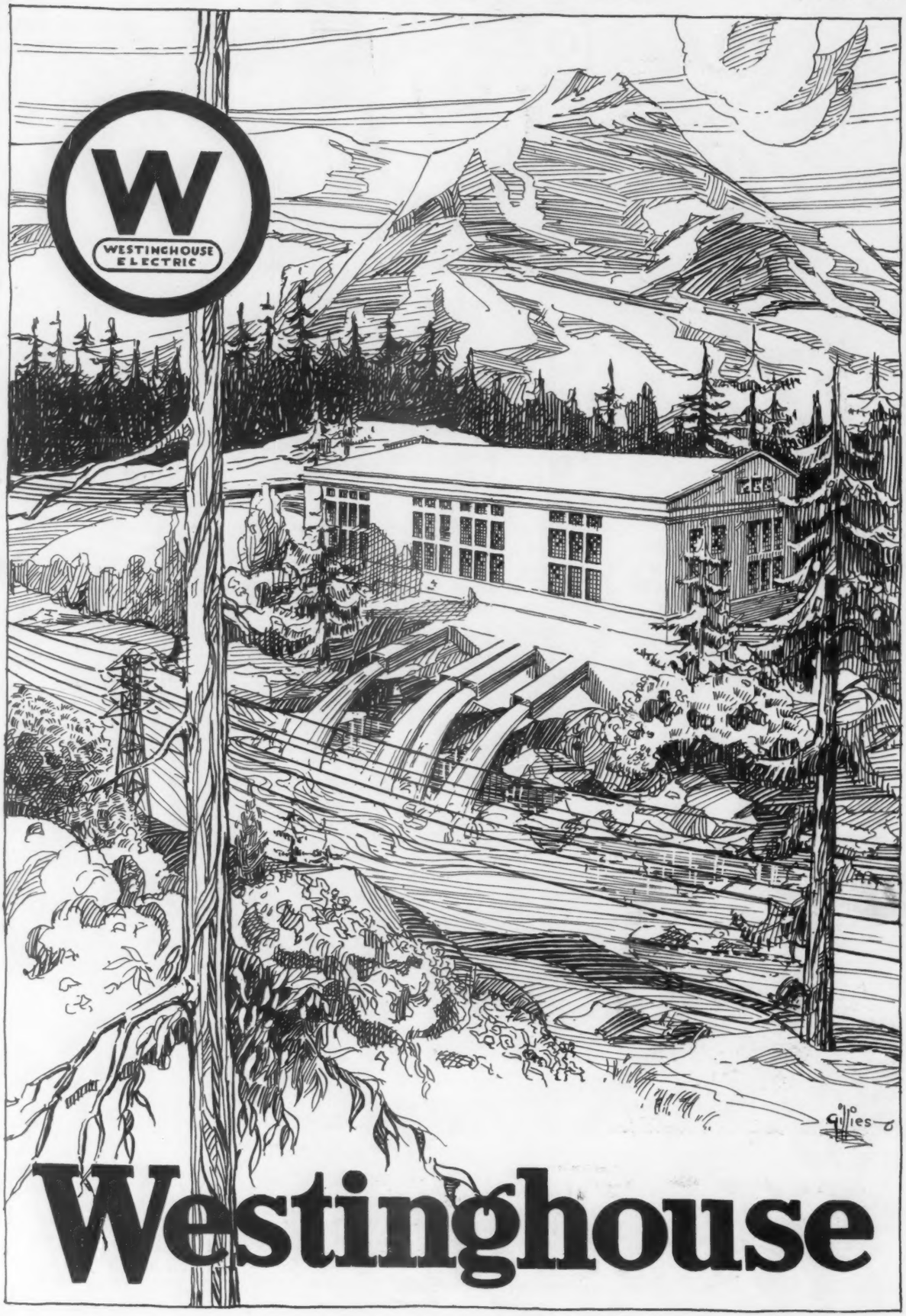
Herewith is a reproduction of one of the Sunday Chronicle Electrica- pages. It is newsy, suggestive, conl structive and has a real advertis- ing urge.

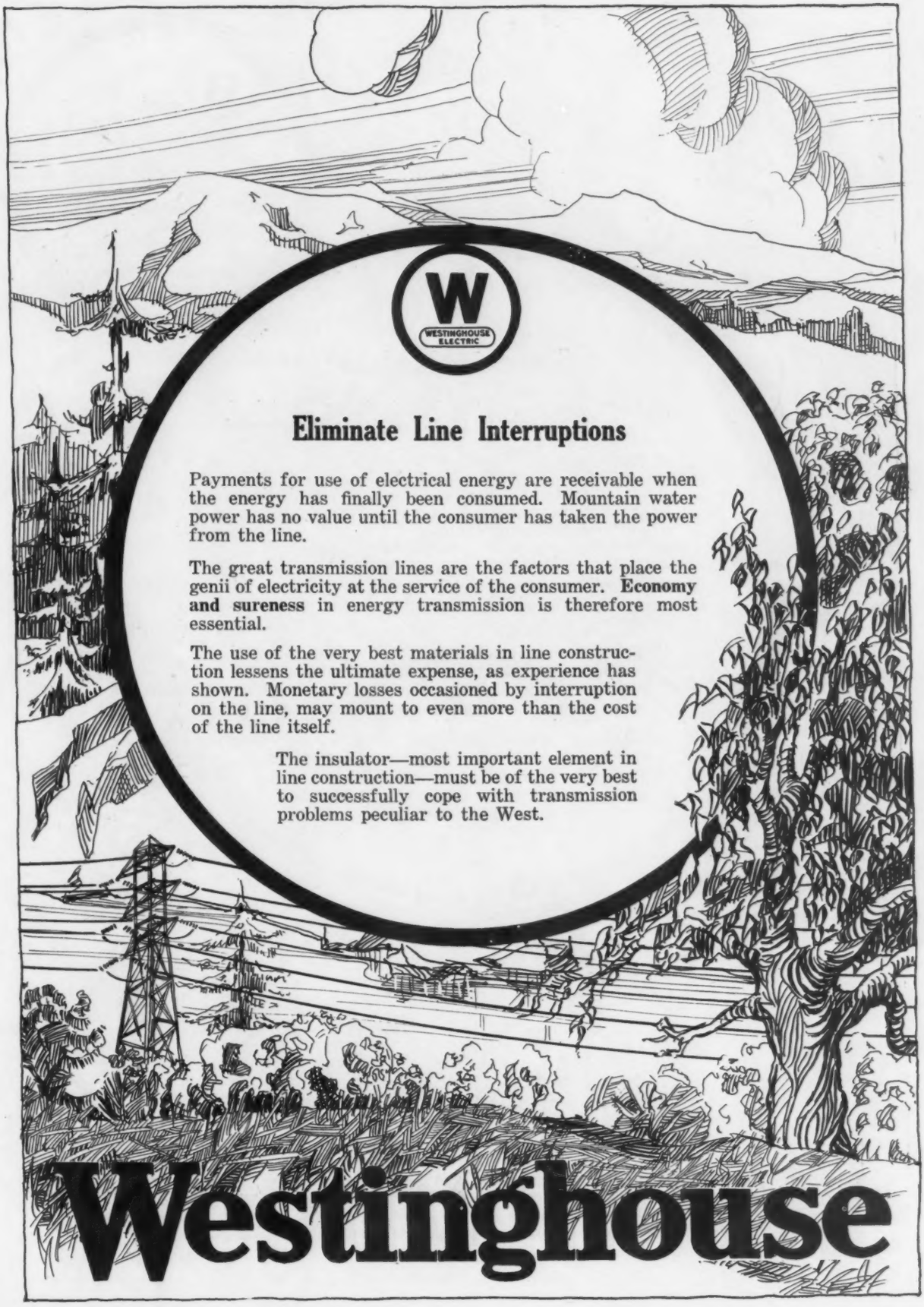
Address Merchandising Service Department for further information.

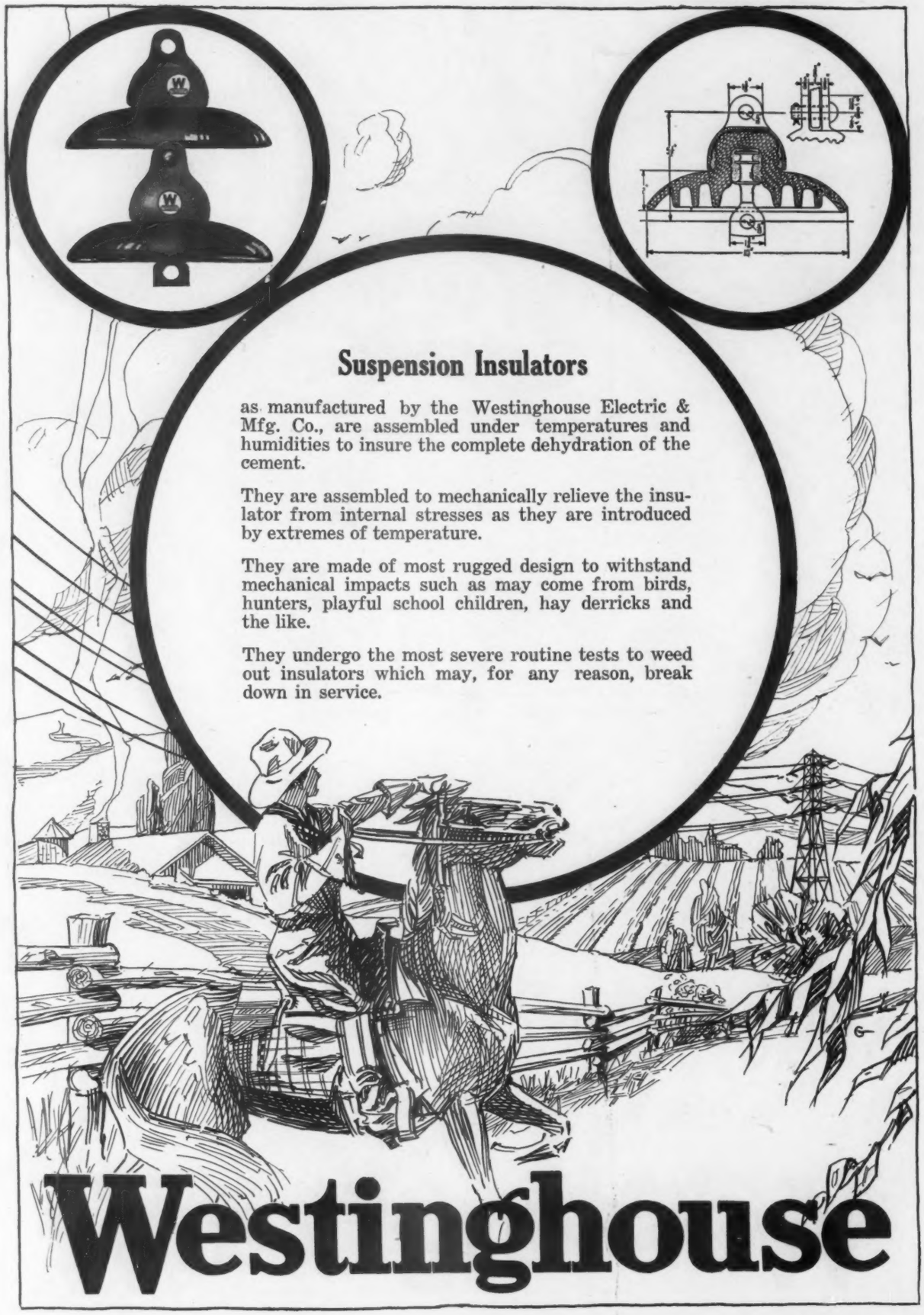
San Francisco Chronicle

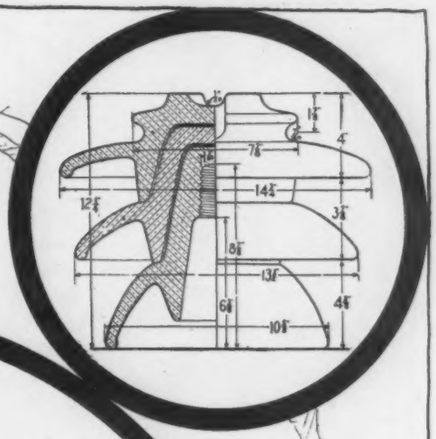
FOR 55 YEARS THE LEADING NEWSPAPER OF THE PACIFIC COAST


W
WESTINGHOUSE ELECTRIC
Insurance For the Line
The West depends upon hydroelectricity; hydroelectricity depends in part, on economic transmission of the energy.
ECONOMIC TRANSMISSION OF THIS ENERGY IS LARGELY A PROBLEM OF PROPER INSULATION.
Whether two large California companies, for example, save many millions of dollars by raising their voltage to 220,000, depends upon what engineering intelligence can do with line insulation.
To this problem much of the thought of the electrical engineers of the West, gathered shortly in Portland for the A. I. E. E. Convention, will be directed.
The whole western electrical industry must cooperate to see that engineering intelligence is given unhampered opportunity to perfect line insulation.
For line insulation has a direct relation to the hydroelectricity the West may use for its prosperity.
Westinghouse


W
WESTINGHOUSE
ELECTRIC
Westinghouse


W
WESTINGHOUSE ELECTRIC
Eliminate Line Interruptions
Payments for use of electrical energy are receivable when the energy has finally been consumed. Mountain water power has no value until the consumer has taken the power from the line.
The great transmission lines are the factors that place the genii of electricity at the service of the consumer. Economy and sureness in energy transmission is therefore most essential.
The use of the very best materials in line construction lessens the ultimate expense, as experience has shown. Monetary losses occasioned by interruption on the line, may mount to even more than the cost of the line itself.
The insulator—most important element in line construction—must be of the very best to successfully cope with transmission problems peculiar to the West.
Westinghouse


Suspension Insulators
as manufactured by the Westinghouse Electric & Mfg. Co., are assembled under temperatures and humidities to insure the complete dehydration of the cement.
They are assembled to mechanically relieve the insulator from internal stresses as they are introduced by extremes of temperature.
They are made of most rugged design to withstand mechanical impacts such as may come from birds, hunters, playful school children, hay derricks and the like.
They undergo the most severe routine tests to weed out insulators which may, for any reason, break down in service.
Westinghouse



FARADOID
Pin Type Insulators

as manufactured by the Westinghouse Electric & Mfg. Co., are particularly well designed to meet operating conditions in the West.

They are of scientific design and assembly to properly distribute the electrical stresses.

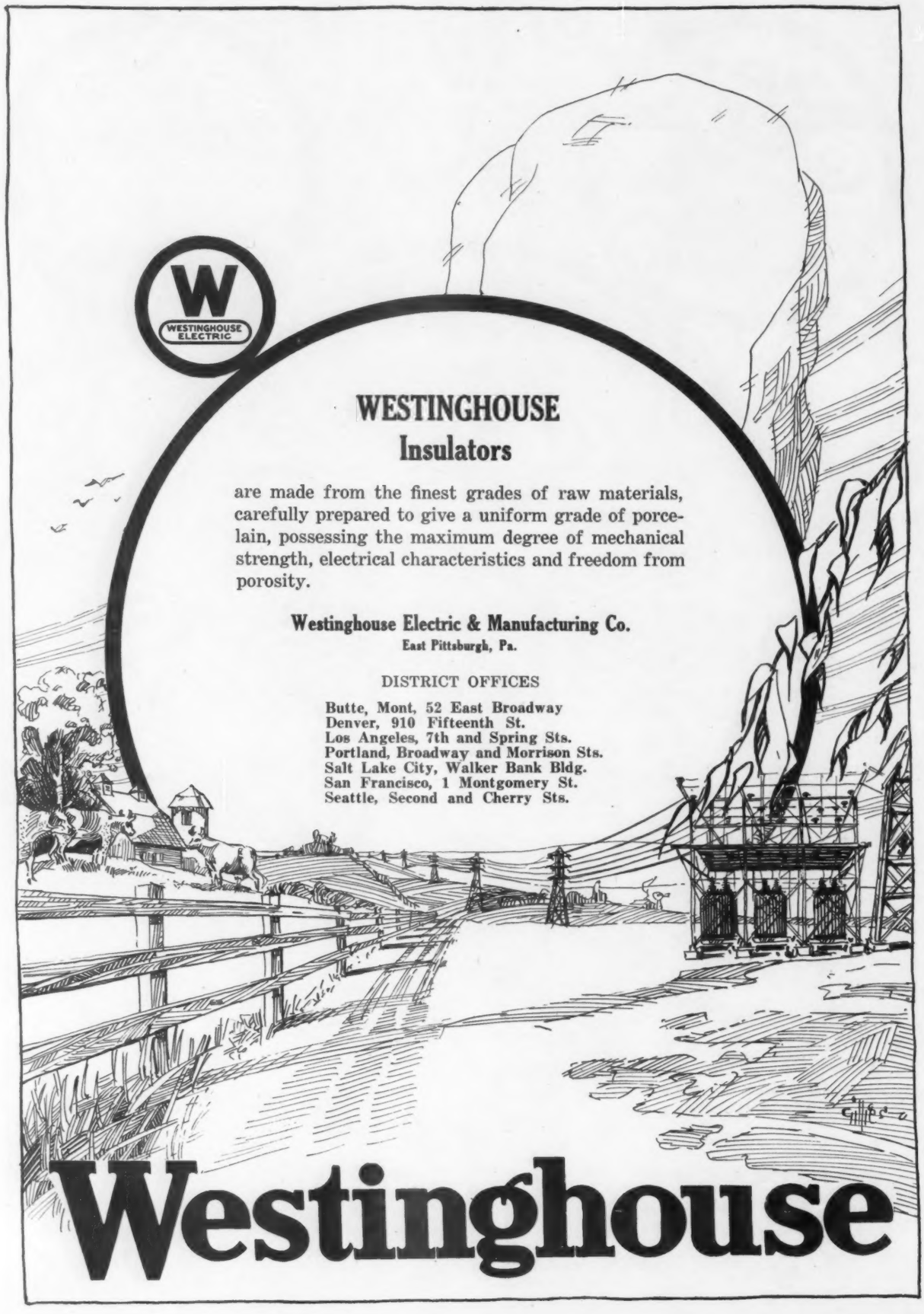
They are designed to make the most effective use of air as an insulator.

They are of high mechanical strength and resistance to side pull; rugged design, to offer greatest resistance to breakage from mechanical impact.

All parts are easily accessible for wiping or cleaning when mounted on the pin.

W
WESTINGHOUSE ELECTRIC

Westinghouse


W
WESTINGHOUSE ELECTRIC
WESTINGHOUSE
Insulators
are made from the finest grades of raw materials, carefully prepared to give a uniform grade of porcelain, possessing the maximum degree of mechanical strength, electrical characteristics and freedom from porosity.
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
DISTRICT OFFICES
Butte, Mont, 52 East Broadway
Denver, 910 Fifteenth St.
Los Angeles, 7th and Spring Sts.
Portland, Broadway and Morrison Sts.
Salt Lake City, Walker Bank Bldg.
San Francisco, 1 Montgomery St.
Seattle, Second and Cherry Sts.
Westinghouse

UNIVERSAL
ELECTRIC IRON

The Hand That Guides The Iron Rules The Sales

WOMAN'S HAND has put the iron business on its feet. The hand that guides the iron rules the sales. Most all electric irons are good, some are better,—ONE is best. The wise woman buys that one. She is on the side of the dealer who sells her a "Universal" Iron. He makes her interests his own by selling her an iron not alone for his profit but for HER PERMANENT SATISFACTION.

THE BUSY WOMAN is quick to anger over an iron that is slow to heat. The "Universal" heats quickly—stays hot. It goes after wrinkles hot and heavy and lays them low. It does all that can be expected of a soundly built QUALITY IRON FOR QUALITY IRONING.

COMPETITION is a good thing for the man who wins—bad for the one who loses. When you sell "Universal" Irons you can meet and defeat competition on QUALITY AND SERVICE BASIS. And on PRICE too, because the appeal of high quality is always greater than the lure of low price.

No. E902

Landers, Frary & Clark

NEW BRITAIN, CONNECTICUT

No. E901

OHIO
TUEC
ELECTRIC CLEANER

OHIO TUEC ELECTRIC CLEANER

The Fool-Proof OHIO-TUEC Has Only Six Assemblies

Every dealer knows what a great advantage this is. Even if a customer does take her OHIO-TUEC apart, she can put its six units back together with perfect ease and without any help or instruction.

The OHIO-TUEC needs to be sold only once and *stays* sold. The customer never bothers *you* because the OHIO-TUEC never gives *her* any bother. It is trouble-proof and fool-proof.

It is to this greater simplicity of design that the OHIO-TUEC owes its greater efficiency.

"Cleans Without Beating and Pounding"

Have you seen our new catalog? If not, write for a copy. Or a postal will bring you an OHIO-TUEC cleaner at our expense for free examination, test and comparison. Write today.

The United Electric Company

Canton, Ohio

Canadian Plant — Toronto, Ont.

Here are some new books that should help you in your work:

The book contractors have been waiting for

Armature Winding and Motor Repair. By D. H. Braymer.

This is a practical shop book on locating and correcting troubles in motors and generators. It answers all questions on armature winding of both d.c. and a.c. machines. The diagrams are so clear that any shop man can follow them. There is but little mathematics so that every point can easily be understood by the man with limited theoretical training. 500 pages, 6 x 9, illustrated. $3.00 net, postpaid.

For the illuminating engineer and salesman

Electric Lighting. By Olin J. Ferguson.

A concise text summarizing the best in modern lighting theory and practice in residences, offices, stores, factories, schools, auditoriums, streets and flood lighting. The treatment is well-balanced and covers all essentials. 243 pages, 6 x 9, illustrated. $2.50.

What wireless enthusiasts knew would come

Radio Engineering Principles. By Lauer and Brown.

This is the first book to bring the science of radiotelegraphy up to date, including the wonderful developments made during the war. It contains complete information on the vacuum tube and its use as a detector, amplifier and oscillator. The discussion on the electron theory is particularly good. 304 pages, 6 x 8, 250 illustrations. $3.50.

For engineers of transmission and distribution

Electric Power Transmission. By Alfred Still.

A new second edition of a standard text on principles and calculations. It thoroughly covers underground as well as overhead systems. 407 pages, 6 x 9, illustrated. $4.00.

Tells how to operate and adjust oil engines

Oil Engines. By L. H. Morrison.

The first modern book on the construction and operation of oil engines. All types of Diesels are described, their installation explained and their troubles analyzed. Semi-Diesels and low compression oil engines are given detailed treatment. 472 pages, 6 x 9, 357 illustrations. $5.00.

The last word on electrical theory

Electric Oscillations and Electric Waves. By Geo. W. Pierce.

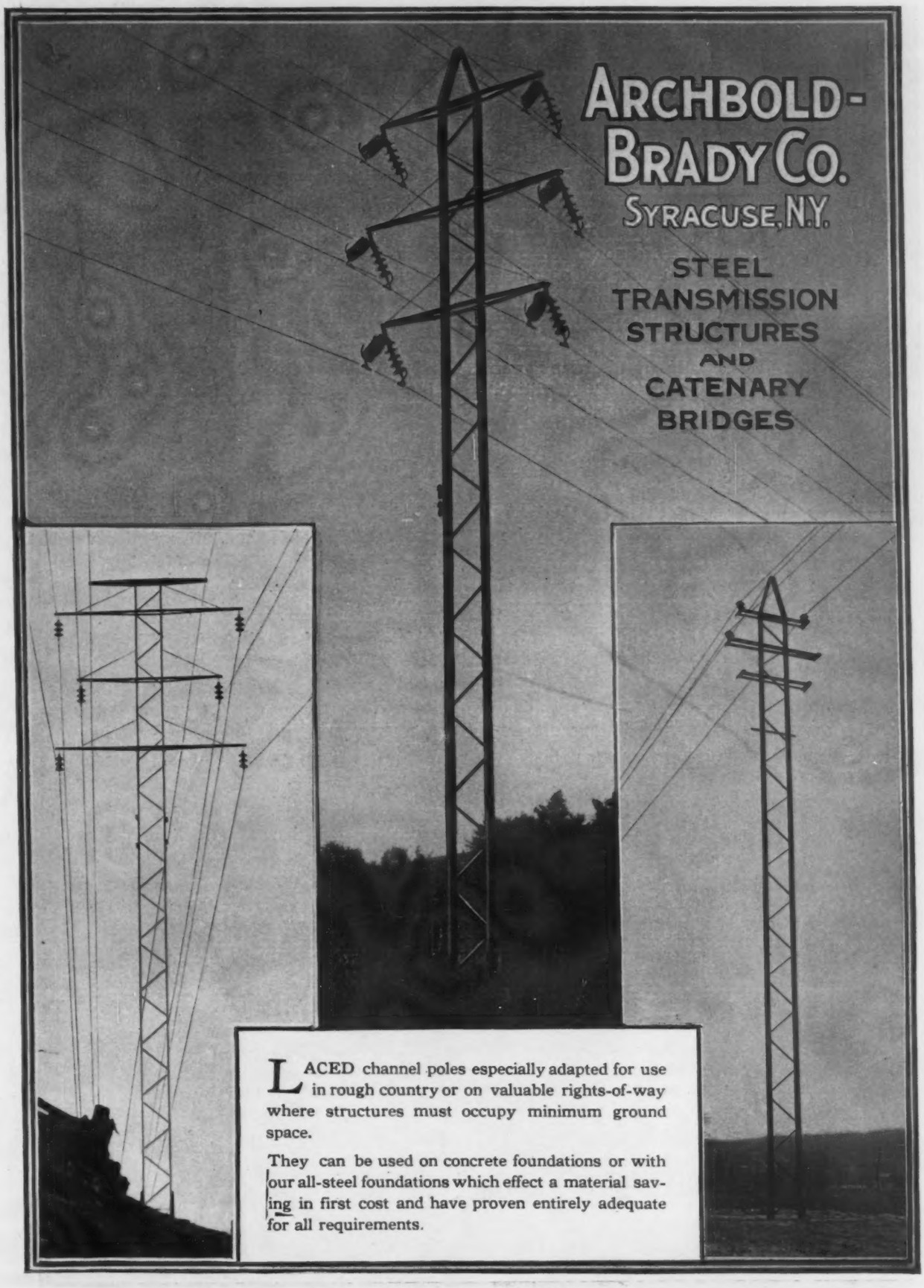
A mathematical treatment of electromagnetic fundamentals. Invaluable to telephone and wireless engineers, physicists and those interested in power transmission. 517 pages, 6 x 9, illustrated. $5.00.

Any of these books will be sent on 10 days approval to Journal of Electricity subscribers. Examine them at your leisure and pay for them if they meet your needs.

225 page 1920 Catalogue sent on request

TECHNICAL BOOK SHOP

531 RIALTO BUILDING SAN FRANCISCO, CAL.


ARCHBOLD-
BRADY CO.
SYRACUSE, N.Y.
STEEL
TRANSMISSION
STRUCTURES
AND
CATENARY
BRIDGES
LACED channel poles especially adapted for use in rough country or on valuable rights-of-way where structures must occupy minimum ground space.
They can be used on concrete foundations or with our all-steel foundations which effect a material saving in first cost and have proven entirely adequate for all requirements.

Bargains for Book Buyers

Because we are now sales agents for the McGraw-Hill Book Co. exclusively, we are selling out our remaining stock of books of other publishers at fractional prices. Most of these books are of recent publication and are a pick-up at the price. Among the number are:

Rushmore & Lof: Hydro-Electric Power Stations. 822 pages, 6 x 9. 1917 edition. Sales price, **$4.50.**

Gear & Williams: Electric Central Station Distribution Systems. 348 pages, 5½ x 8. 1911. Sales price, **$2.00.**

Wilson: Essentials of Electrical Engineering. 346 pages, 6 x 9. 1915. Sales price, **$1.50.**

Trinks: Governors and the Governing of Prime Movers. 236 pages, 6 x 9. 1919. Sales price, **$2.50.**

Foster: Engineering Valuation of Public Utilities and Factories. 361 pages, 6 x 9. 1913. Sales price, **$2.00.**

Hayes: Public Utilities, Their Fair Present Value and Return. 220 pages, 5¾ x 8½. 1915. Sales price, **$1.50.**

Edgcumbe: Industrial Electrical Measuring Instruments. 414 pages, 5½ x 8. 1918. Sales price, **$3.00.**

Shepardson: Telephone Apparatus. 338 pages, 6 x 9. 1917. Sales price, **$1.50.**

Still: Principles of Transformer Design. 216 pages, 5 x 7½. 1919. Sales price, **$2.00.**

Frith: Alternating Current Design. 131 pages, 5½ x 8¾. 1912. **$1.50.**

Latta: American Producer Gas Practice. 547 pages, 7¾ x 10¾. 1910. Sales price, **$4.00.**

Hawkins Electrical Guides. Each volume about 350 pages, 4½ x 6½. 1917 edition. Price, per volume, **$0.75.**

No. 2—Management of Dynamos & Motors.
No. 3—Wiring and Distribution Systems.
No. 8—Telegraph—Wireless—Lighting
No. 9—Railways—Movies—Autos.
No. 10—Modern Applications.

Timbie: Essentials of Electricity. 272 pages, 5 x 7. 1915. Sales price, **$1.50.**

Timbie & Higbie: Essentials of Alternating Currents. 374 pages, 5 x 7. 1919. Sales price, **$1.25.**

Lauffer: Resuscitation. 47 pages, 4 x 6½. 1914. Sales price, **$0.35.**

Grunsky: Topographic Stadia Surveying. 100 pages, 4½ x 7. 1917. Sales price, **$1.50.**

Oudin: Standard Polyphase Apparatus and Systems. 370 pages, 5 x 8. 6th edition. Sales price, **$1.50.**

Fleming & Johnson: Insulation and Design of Electrical Windings. 224 pages, 6 x 9. 1913. Sales price, **$1.75.**

Due to the low prices on these books we cannot pay carriage charges, allow return or carry on open account. As all orders are subject to prior sale this opportunity should be grasped at once

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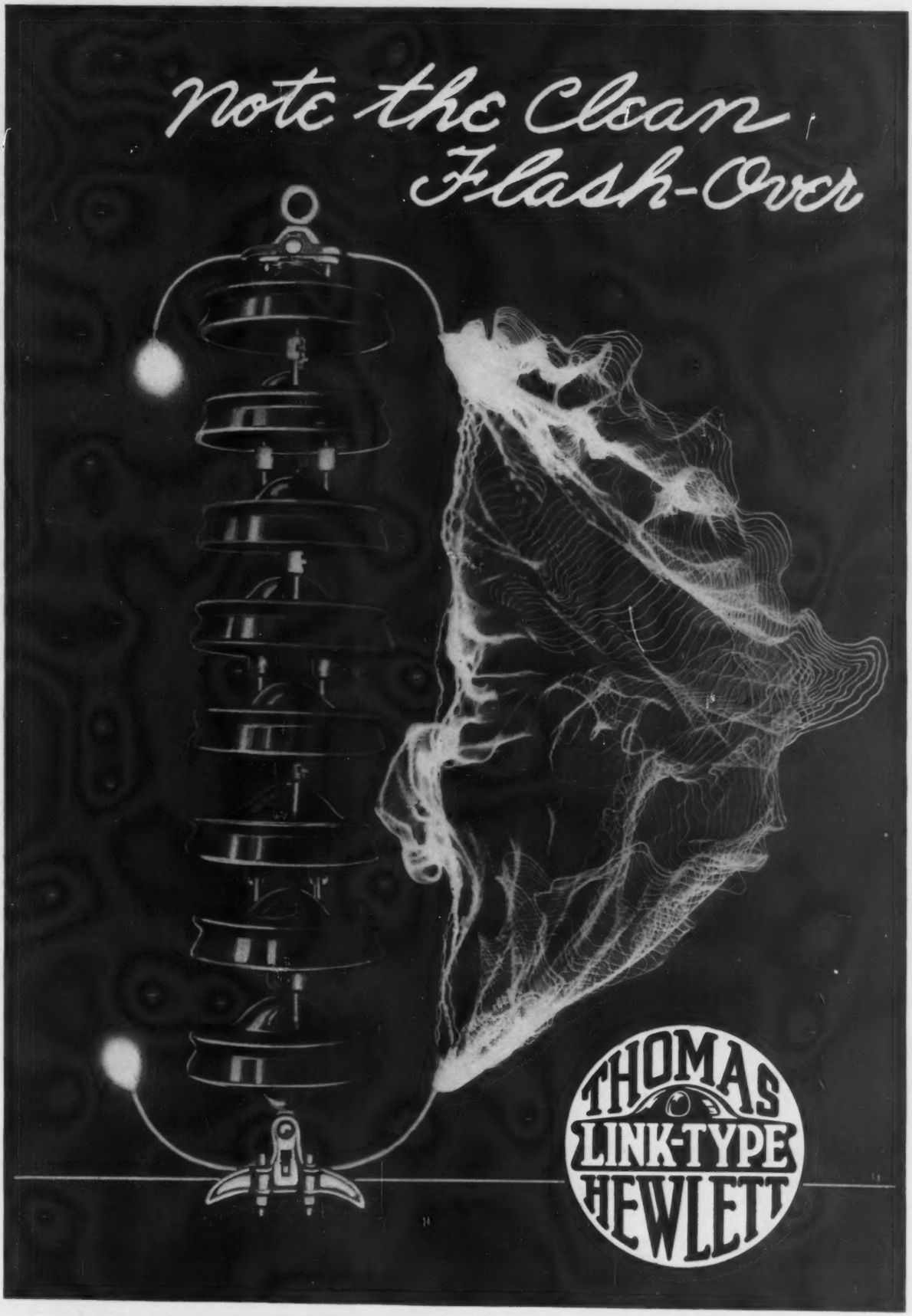
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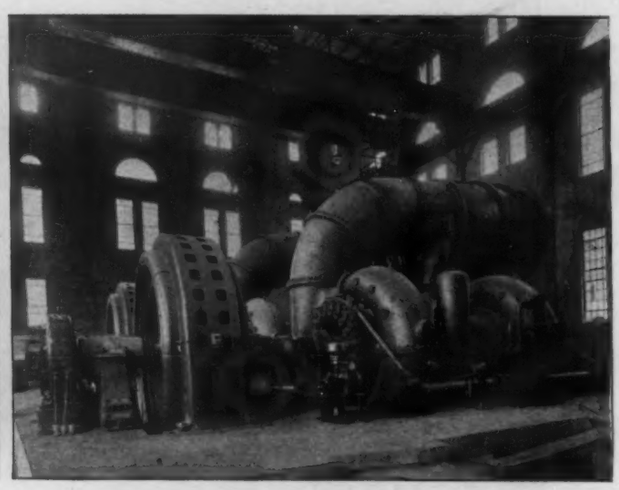

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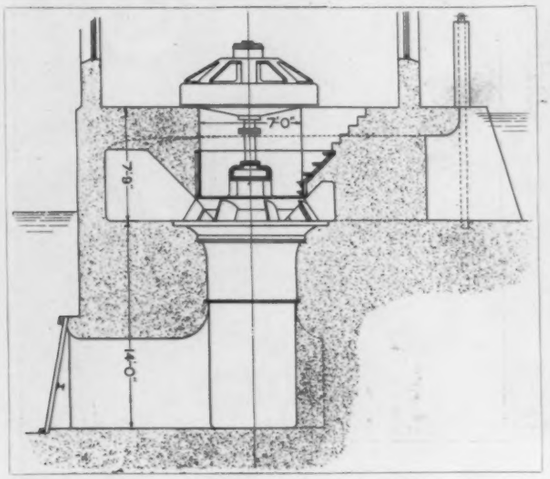

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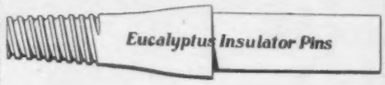

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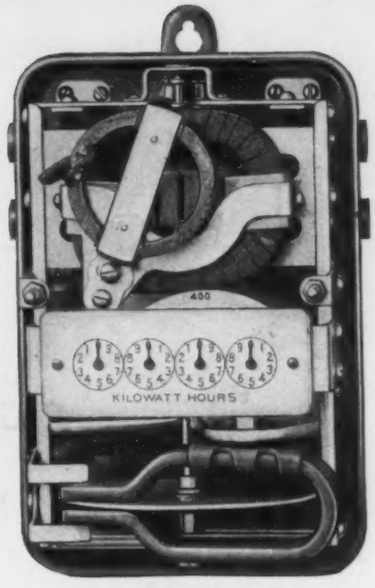

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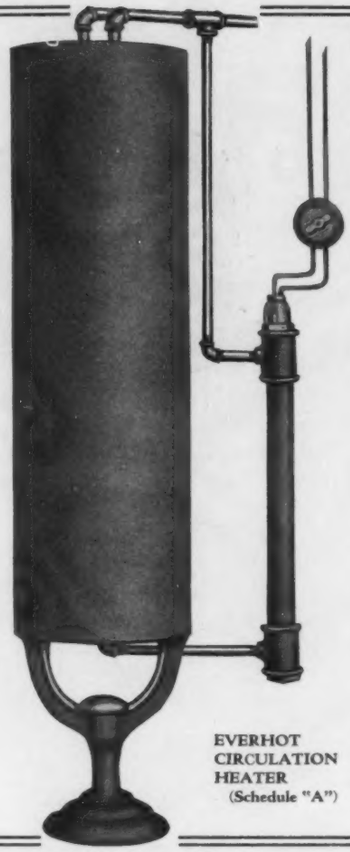

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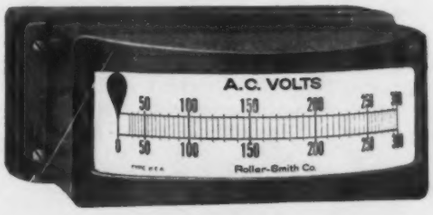

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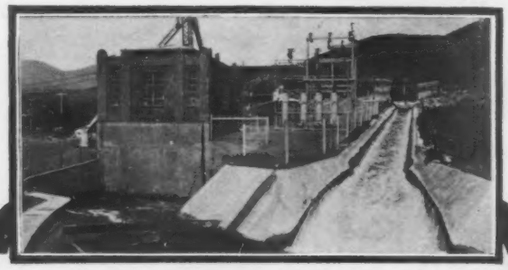

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The practical man will welcome Braymer's **Armature Winding and Motor Repair,** which gives common-sense data on locating motor troubles, practical ways of correcting them, the testing of motors before and after repair and the things to look for when inspecting and overhauling motors and generators. It deals with actual shop practice in armature winding, not theory. In its 500 pages are numerous diagrams and other information never before published in book form which will be particularly useful to shop men in winding direct and alternating current machines. It is written especially for the every day use of the industrial plant electrician and repair man. The price is $3.00.

A new third edition of Daugherty's **Hydraulic Turbines** has just been published. This gives a brief treatment of water power development and conditions affecting turbine operation, a statement of the principal features of construction of modern turbines, an outline of the theory and the characteristics of the principal types, commercial constants, means of selection of type and size of turbines and cost of turbines, including both tangential and reaction types. The author, Prof. R. L. Daugherty, has recently resigned as professor of hydraulic engineering at Rennselaer Polytechnic Institute, to join the faculty of the California Institute of Technology at Pasadena, Calif. The price is $2.25.

Every contractor, fixture man and lamp salesman will be interested in Ferguson's **Electric Lighting.** Here between the covers of one book are the fundamental principles and the best in modern practice of electric lighting for residences, offices, stores, factories, yards, streets, schools, auditoriums and art galleries. It contains complete discussion on wiring and apparatus, types of lamps, photometry, color and illumination calculations. It contains 293 pages and sells for $2.50.

Prof. Geo. W. Pierce of Harvard has written a new book, **Electric Oscillations and Electric Waves,** which will be of special value to engineers having to do with telephony and power transmission as well as those interested in wireless telegraphy. It presents a mathematical treatment of the fundamentals of electromagnetic theory and is destined to be recognized as the most thorough and painstaking presentation of advanced radio theory that has yet appeared. The price is $5.00.

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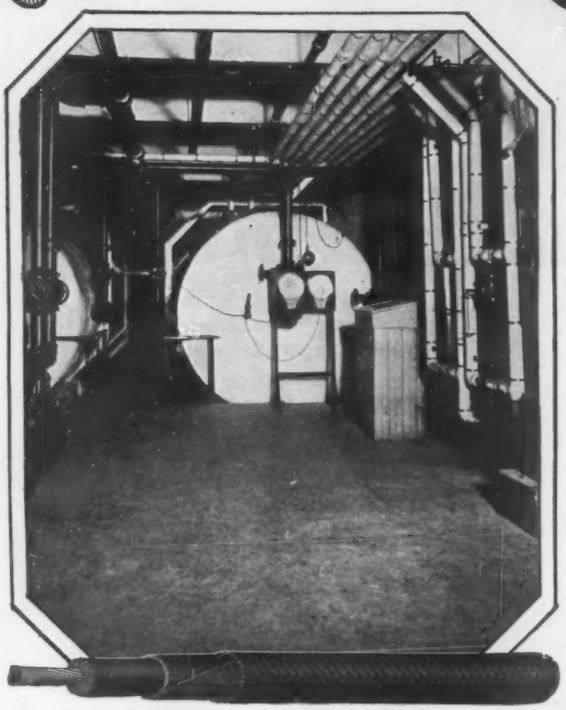

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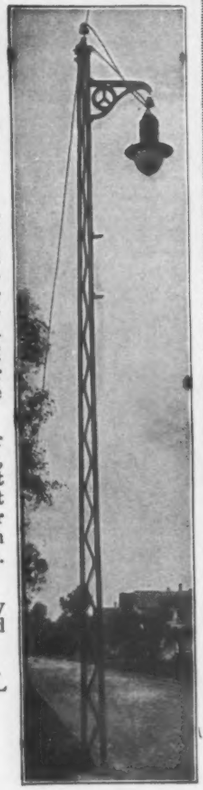

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Hemingray Glass Company
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Federal Electric Company
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Pacific States Electric Company
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Federal Sign System (Electric)
Franklin Incandescent Lamp Wks.
National Lamp Works
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Federal Sign System (Electric)
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National Lamp Works
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Electric Storage Battery Co.

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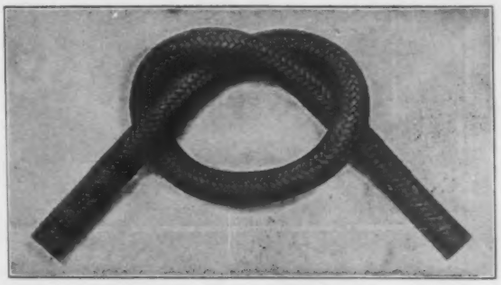

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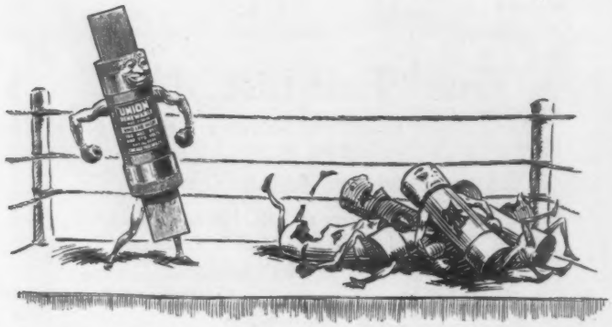

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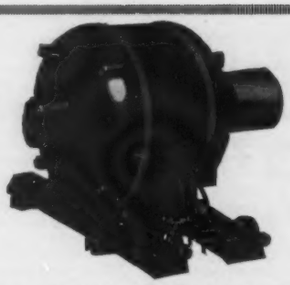

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Howell RED BAND ELECTRIC Motors

PRACTICAL IDEALISM IN PUBLIC SERVICE

is the title of the book written by S. M. Kennedy, Vice-President in charge of Public Relations and Business Development of Southern California Edison Company. The following is a list of subjects treated:

1—The Point of View
2—The Value of Courtesy
3—The Man in the Street
4—Room at the Top
5—Congenial Contacts
6—That the People May Know
7—The Display Room
8—The Spirit of Progress
9—The District Manager
10—Potential Publicity
11—The Commercial Instinct
12—The Art of Conciliation
13—Service
14—Cumulative Cooperation
15—I Thank You

Price $2.50. Orders now being received for delivery on day of publication.

TECHNICAL PUBLISHING COMPANY
Rialto Building San Francisco, Cal.

More light for each year of life

THIS is the title of the fifth full page advertisement in the Edison MAZDA lamp campaign in the Saturday Evening Post. It appears in color in the issue of July 10th.

And the more light there is in each year of life, the more Edison MAZDA lamps can be translated into sales by the use of this advertising.

A large size reproduction of the advertisement in two colors and a four-color poster enlargement of the painting itself, have already been sent to every Edison MAZDA lamp Agent for display purposes.

A wooden frame to hold the poster, as shown in the window display above, is furnished Edison MAZDA lamp Agents on request, as part of our publicity service. This display also shows two of the new lamp holders and new white MAZDA lamp cut-out in assortment 105-A which is now ready to be sent our Agents on order.

This is the fifth painting in a series by Norman Rockwell. Every four weeks throughout the year a new painting will be used in our Saturday Evening Post advertisement, and three weeks in advance of each, a poster enlargement will be mailed to every Edison MAZDA lamp Agent. The next advertisement will appear in the August 7th issue of the Post.

EDISON MAZDA LAMPS G-18

EDISON LAMP WORKS OF GENERAL ELECTRIC COMPANY

Unexcelled designing and manufacturing resources, coupled with large productive facilities, insure accuracy of detail and overall excellence

Form C Single Phase **Motors**

As the illustration partly shows

Before motors are assembled, each part is carefully checked to insure interchangeability and fitness for accurate assembly.

Shafts: All diameters are tested by micrometer gauge, lengths being checked by calipers and linear scales.

End Shields: Snap gauges are used in checking outside diameters and a plug gauge with maximum diameter on one end and minimum diameter on the other is used to prove bearing sizes. 1/1000 of an inch is the allowed variation between maximum and minimum.

Stators: Distance between faces is calipered and snap-gauged to determine if diameters are correct to standard.

We have mentioned only a few of the precautions insuring interchangeability and accuracy of motor assembly — *your protection against operation troubles.*

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

45-59

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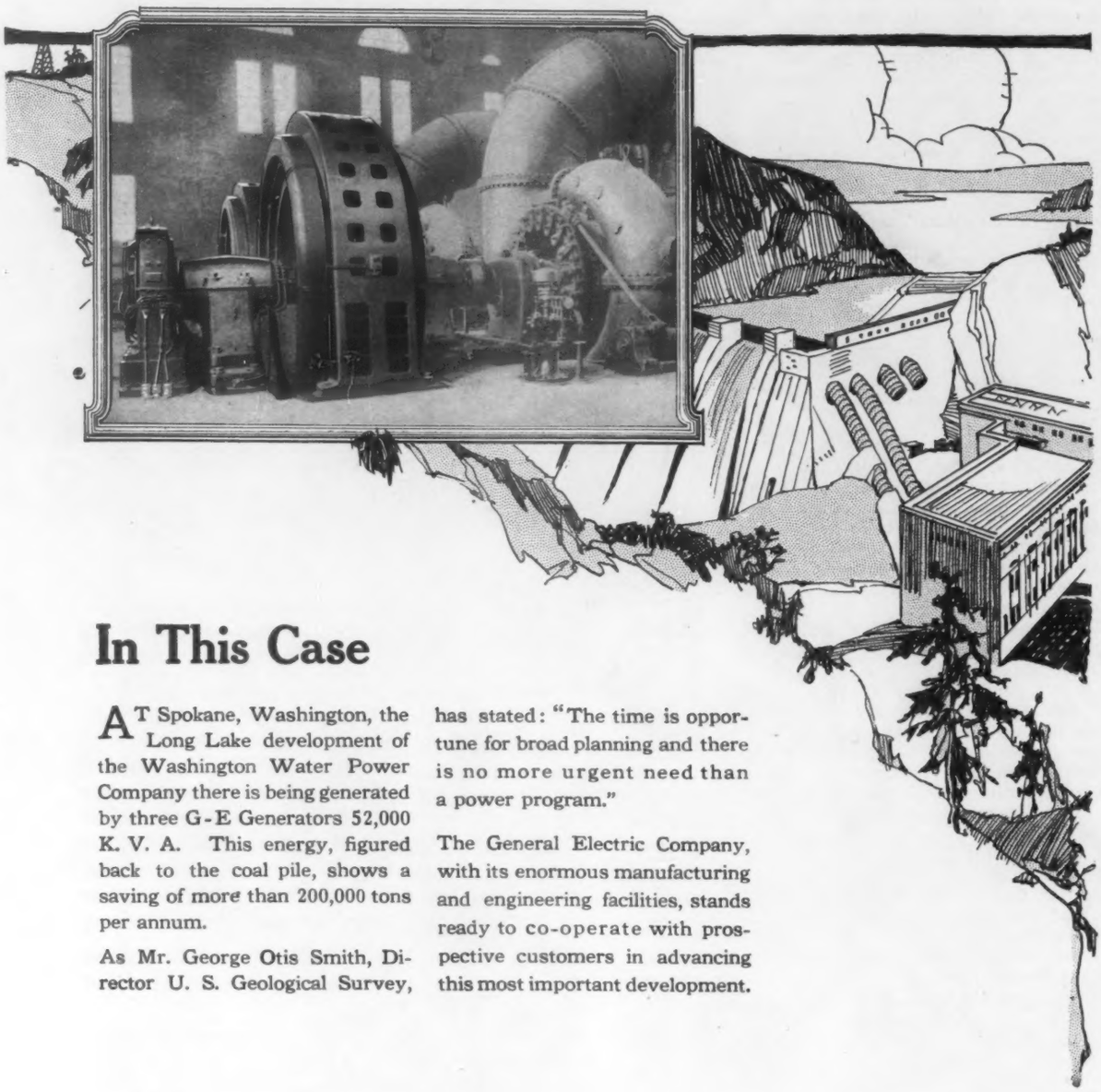
Are you aware that only approximately one-sixth of the available water power of this country has been harnessed?



In This Case

AT Spokane, Washington, the Long Lake development of the Washington Water Power Company there is being generated by three G-E Generators 52,000 K. V. A. This energy, figured back to the coal pile, shows a saving of more than 200,000 tons per annum.

As Mr. George Otis Smith, Director U. S. Geological Survey, has stated: "The time is opportune for broad planning and there is no more urgent need than a power program."

The General Electric Company, with its enormous manufacturing and engineering facilities, stands ready to co-operate with prospective customers in advancing this most important development.

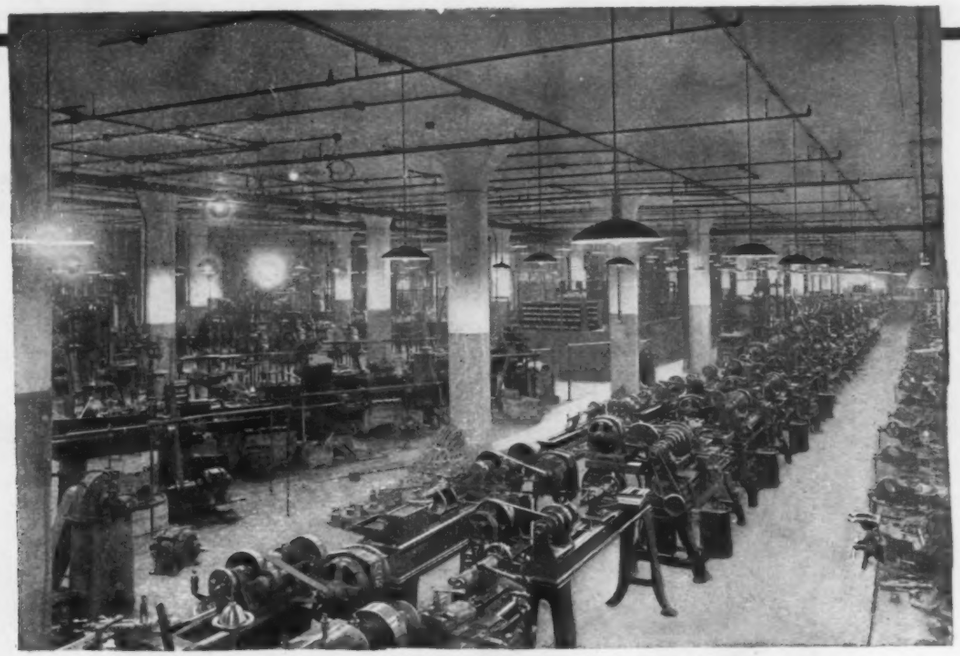
General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

29-10

To hold the good will of your industrial plant customers, help them maintain maximum production by supplying 100% voltage.



Out-door type three-phase feeder voltage regulator.

FACTORIES may contain the latest types of fixtures and lamps; but this excellent equipment will avail them but little if the lamps are not supplied with proper voltage.

A ten per cent. drop in voltage means over a 30% reduction in candle-power.

Poor voltage regulation of lighting feeders to the industries, results in "hold-ups", stoppage, spoilage, wasted time, eye strain and other losses in production.

G-E Induction Voltage Regulators

furnish the means for maintaining constant voltage under all conditions of load on feeders.

Regardless of what your requirements may be, there is an appropriate G-E regulator available.

Send for Bulletin 45505

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

33B-14

The FEY AUTOMATIC GRIP HICKEY

"STICKS WHERE IT GRIPS"

for Conduit Installation and General Pipe Bending

Bends Pipe Quickly

No Kinking—No Breaking—No Flattening

WRITE FOR PRICES

BULLEN & COMPANY

1508 Claus Spreckels Bldg. San Francisco, Calif.

LE Ja'22